a permeable membrane. Playing or swimming in a clean lake or ocean that is rich in minerals can facilitate recovery from demanding exercise and promote health, since the skin is actually a more porous membrane than commonly imagined, and water is the most remarkable solvent in the world. The use of mineral springs to aid or restore health also has merit. The skin can then serve as a selectively permeable membrane, enabling the body to pull from the water what it needs—and simultaneously eliminate what it does not. Accordingly, by taking a dip in the ocean after running in the sand dunes, the athletes who trained with Australian coach Percy Cerutty enjoyed an ideal environment and training practice. Often, runners who fear their athletic season ruined due to excessive training, racing, or travel can quickly recover and deliver their personal records by getting proper nutrition, rest, and taking several dips in a refreshing lake or ocean.

- An athlete's vital capacity, (i.e., the maximum volume of air they can inhale while breathing) and breathing technique can directly affect their aerobic ability and performance. After all, running has a lot to do with breathing. To inhale, the pressure on the lung cavity must be relieved to create a vacuum. It requires muscular effort to take the pressure off of the lung cavity so that the atmospheric pressure (14.69 pounds per square inch and 760 mm of mercury) can do its handiwork and refill the lungs with needed oxygen. How many athletes today conduct breathing exercises? How many coaches even think they should? The intercostal muscles and diaphragm can benefit from strengthening and stretching, particularly after a demanding running workout. An athlete can accomplish this by conducting pull-ups, push-ups, jumping jacks, the bench press, or by hanging vertically from an overhead bar. Lying flat on your back on a firm floor, and sleeping on a firm futon are also beneficial. Again, an athlete should consider Percy Cerutty's writings on the subject of breathing (Cerutty, 1964, and 1967). He observed that many athletes insufficiently fill their lungs while breathing during strenuous exercise. Cerutty also taught and understood tidal, or so-called Zen breathing, and the physical, mental, and "spiritual" implications of correct practice. An in-depth treatment on the subject of breathing can be found in the works of Karlfried Graf Dürckheim (Dürckheim, 1986, and 1988).
- Concerning an athlete's demonstrated aerobic ability and anaerobic threshold, one should also consider the human body as an electrical phenomenon. Ultimately, all the chemical processes in the body are electrical in nature, with muscular contractions being an obvious case in point. The earth has a charge. So does the atmosphere. Man has a charge or electrical potential. And the human body contains different electrical potentials and gradients, some of which generally correspond to the meridians known in acupuncture or acupressure. Hard work necessarily changes some of those potentials, and an individual's recovery and acquisition of fitness is dependent upon their restoration (Becker, 1987).

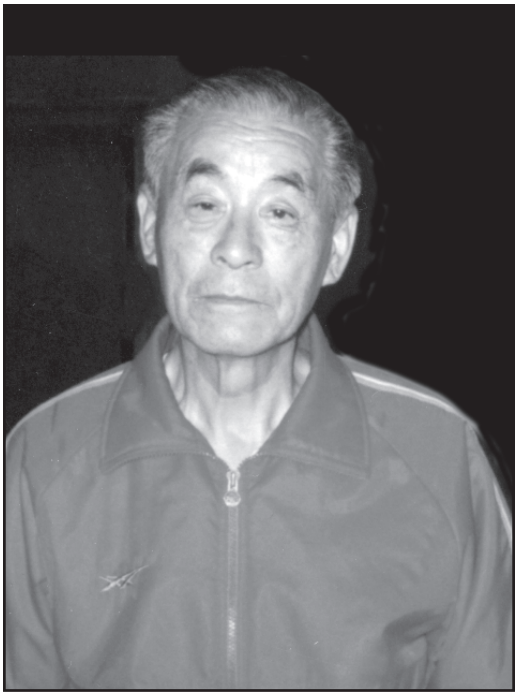


Photo 2.5—Master Kiyoshi Nakamura, coach of Japanese distance runner Toshihiko Seko. Photo courtesy of Nobuya Hashizume.

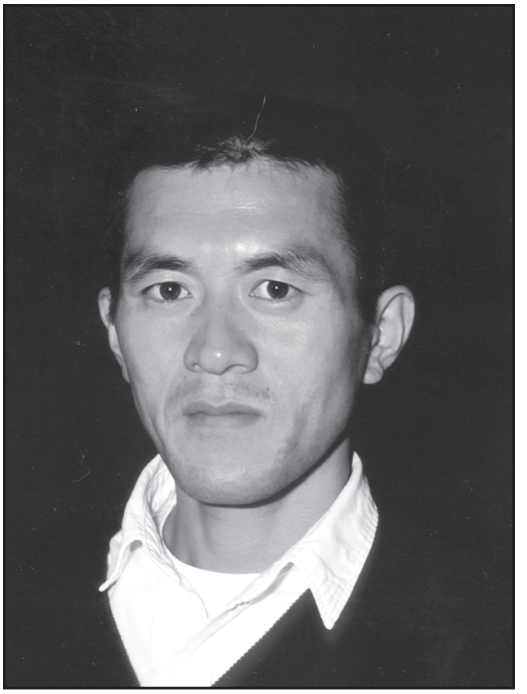
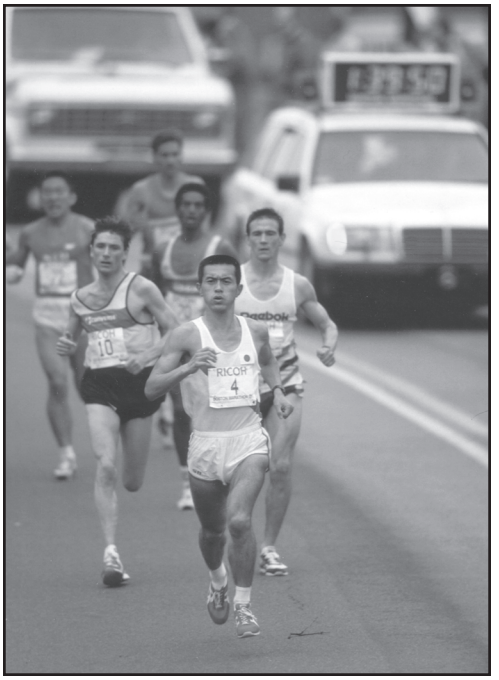


Photo 2.6—Toshihiko Seko, Boston, Massachusetts, 1987. Photo from Victah Sailer/Photorun.

Accordingly, walking or running barefoot on grass or a sandy beach influences the electrical potentials within the body and speeds recovery. Swimming may be even better in this regard, although runners can do without the chlorine found in indoor pools. However, swimming or splashing about in a lake or the ocean surf can greatly accelerate recovery. Massage therapy can also be effective, for the same reason. Athletes in the United States often run in electrically non-conductive footwear, and upon hard asphalt surfaces. That is not natural, and what is not natural is generally not good. Perhaps, this bioelectrical phenomenon can be measured and scientifically proven, but only with great difficulty (given the number of variables and the subjective nature of human perception). However, when you see the same positive reaction from a large number of athletes to certain stimuli over a number of years, the question concerning just how or why becomes something of a moot point. All the science in the world cannot tell us as much about the effects of a given training variable upon an individual as one simple question: “How do you feel?”

An individual’s mental state can greatly influence the anaerobic threshold. Physical tension resulting from anxiety, and the associated biochemical changes it induces in the body, can dramatically reduce an athlete’s exhibited aerobic ability. Make sure you have the mental game in hand. Otherwise, the fittest athlete in the world will not be able to demonstrate it on the appointed day and hour.

PHOTOS 2.7 — Toshihiko Seko running the Boston Marathon, 1987
photos from Victah Sailer/Photorun



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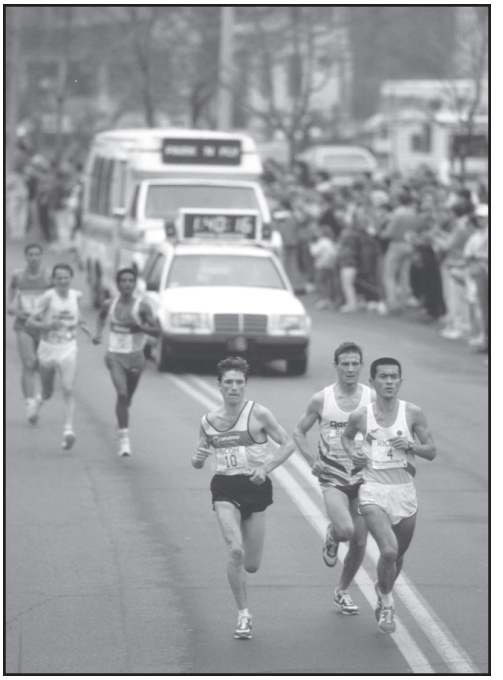

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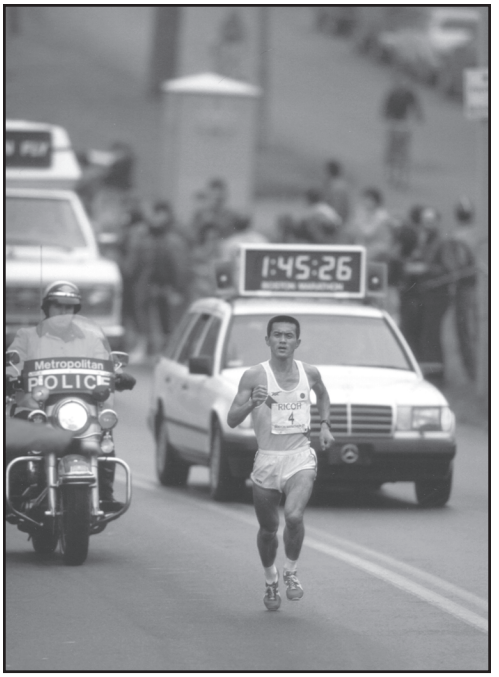
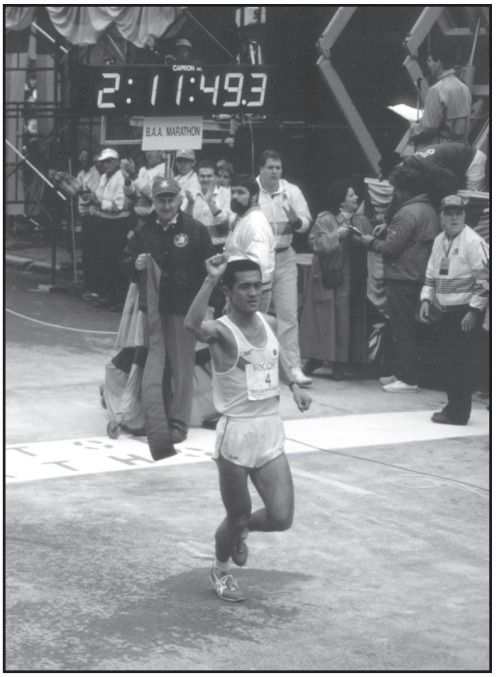


Gone!



Zanshin… Perfect finish!

Hopefully, this brief digression on various factors that can affect aerobic ability will shake things up a bit, and possibly get the reader thinking in new dimensions about athletic training. Again, everything matters. Everything is interrelated. Life is an interpenetrating and indissoluble unity—so the question of what influences aerobic ability, and how, is never an easy or simple one to answer.

> ***The structure of the absolute now is such that the past, present, and future, in an epochal whole… are not arranged in a linear fashion but realized simultaneously in the manner of mutual identity and mutual penetration***
>
> —Dōgen Kigen

Nevertheless, in this country many tend to suppose that athletics is simply what happens in the workouts. There is much to be said for the method of the Australian coach Percy Cerutty, who frequently had athletes reside at Portsea, and also the Japanese coach Kiyoshi Nakamura, who had Toshihiko Seko live with him for a while (Maier, 1981). Why? In order to teach athletes how to live. Most of the things that influence athletes happen in the other 20-plus hours a day spent away from formal training. Everything in life will impact athletic performance, and that certainly includes character development. After attaining victory in a marathon, Seko was taught to erase the ego by meditating in a temple. Too many athletes think the right way to celebrate after a victory is to meditate in a pub and solicit the attention of the opposite sex. Two more contrasting attitudes to the way of athletics cannot be imagined.

Base Period Duration: High School

For young high school athletes (or those whose physical age corresponds to that of a freshman or sophomore), training for the cross-country season should begin with the first day of organized team practice. Make sure that young people enjoy a lengthy period of post-season recovery prior to beginning a new athletic season, since demanding training tends to suppress the natural maturation process, and vice-versa. In the United States, organized cross-country team practice normally begins in mid-August. Young cross-country runners will often desire to peak for their conference and regional championships, during the last two weeks of October. Allowing for an ascent of nine to 10 days and three to four weeks of sharpening work, indicates that the base period should conclude by the end of the third week in September. That normally provides a total of six weeks of base work during the high school cross-country season. During a high school season of 12 weeks, all that a coach can do with young athletes is to bring them into a respectable state of fitness to minimize the risk of injury during competition, and thereby uncover what God has granted in the way of natural talent. It is a much harder job than most imagine.

High school juniors and seniors (or more mature athletes participating in cross-country), would be able to begin the base period in preparation for cross-country around the first of July, and focus on the state cross-country championships generally held in the first week of November. This still permits a month respite after the conclusion of the previous track season. It also provides an additional five to six weeks of preparation prior to the beginning of organized team practice. This effectively doubles the length of the base period for juniors and seniors relative to freshmen and sophomores.

The same prescription holds true for athletes participating in track and field during the spring. Base work for young high school athletes should begin on the first day of organized team practice, which in the United States is generally the first week of March. Most runners will want to deliver optimal performances in the conference and regional championships held during the last two weeks of May. The state championship meets traditionally come in late May or early June. This means that base and hill work must conclude by the end of the third week in April. This allows for roughly seven weeks of base and hill work during a track season lasting approximately 14 weeks. Young high school athletes should take much of the winter season off and engage in some other non-competitive sport or activity. The more mature high school athletes could begin a build-up by the middle of January, which would provide an additional six weeks of preparation for the track and field season. An elite high school athlete participating in the national high school cross-country championships would not finish cross-country until late December, and thus would require a period of post-season recovery extending until the middle of January.

Base Period Duration: Division 1

Collegiate men and women competing in conference track championships in late May should take two to four weeks of post-season recovery, and begin base work for the cross-country season by the first of July. However, athletes competing in the NCAA Track and Field Championships, and the USATF National Championships, might not resume training until the middle of July, after taking two to four weeks of post-season recovery. This presents no problem with regard to their cross-country preparation, since these athletes would focus on the conference championships at the end of October, and in particular, the NCAA Cross-Country Championships in the middle of November. Accordingly, the base and hill periods for collegiate athletes will often extend nearly through the end of September.

Collegiate athletes should take two to four weeks of post-season recovery following the conclusion of the cross-country season. Base and hill work could then begin by the middle of December and continue through the end of January. That would provide three to four weeks of sharpening work prior to taking the nine-to-10-day ascent to a brief plateau of peak performance for the indoor conference track and field championships. Athletes should then return to base and strength work immediately afterwards. To continue with sharpening work and racing would severely compromise competitive results during the outdoor track season. The athletes would then be trying to build on a foundation that was no

longer there. However, there is little time to complete regenerative base and hill work. Assuming that the outdoor conference track and field championships come in the third week of May, base and hill work must be completed by the first or second week of April. This only provides time for five or six weeks of base and hill work prior to sharpening for the outdoor conference track and field championships.

Too Many Seasons

Young collegiate athletes commonly ask: is it possible to peak for indoor and outdoor track, and still get optimal results in both? No, it is not possible for a distance runner. Athletes can sharpen up a bit for the indoor season to obtain a respectable result, but if they try to put their eggs in both baskets, they will likely fall between the cracks. The more athletes sharpen for the indoor season, the more they will compromise their performances during the outdoor season. You can only have two optimal competitive seasons during the athletic year at the Division 1 level, that is, cross-country and outdoor track, and even here, one season must have precedence over the other.

Some collegiate athletes do occasionally compete and win multiple titles in cross-country, indoor, or outdoor championships. Realize that they can do this only because they are exceptional—so superior that they do not have to be in their best form to nevertheless dominate the competition. However, the long-term prognosis for these individuals is dim, as most will not be able to survive this treatment for long and enjoy a post-collegiate career. This problem can be aptly described as the “battered athlete syndrome.”

Coaches and athletes desiring optimal performances outdoors should then limit the sharpening work for the indoor season to three weeks. Further, the quality of the sharpening work conducted by mature athletes for the indoor season should be reduced on the order of one second/400 meters from the projected goal performance in the main race event for the outdoor season, and nearer two seconds/400 meters for young developing athletes. For example, a mature athlete projecting a 4:00 mile performance outdoors would prepare for 4:04 indoors. An athlete projecting 14:00 for 5,000 meters outdoors would then aim for 14:12 indoors, and so on.

Again, young developing athletes should aim at something closer to outdoor goal pace plus two seconds/400 meters during the indoor season. They should also race infrequently, and if possible, over-distance or under-distance with respect to the main race event. By competing over-distance with respect to the main race event, runners will enhance their endurance and stay relatively close to the base work. This would also enhance their ability to recover from future preliminary rounds, and compete during the outdoor season. Alternately, runners could develop their finishing speed by competing under-distance with respect to the main race event, perhaps in the 400 or 800 meters. If limited, this practice does not sharpen athletes, which is a critical consideration, but rather merely enhances their finishing speed. Coaches and athletes will then be training through the indoor season, while still obtaining respectable results. However, the

more frequently athletes race indoors and compete in the main race event, the more they will be sharpened and forfeit optimal performance outdoors. Accordingly, the development of the runners could be compromised, and they might not substantially improve during their collegiate careers.

The hazards presented by the existence of three collegiate competitive athletic seasons leads to an essential point: collegiate distance runners should not compete in three athletic seasons. Once again, it would be best, from the standpoint of both their academic and athletic development, if collegiate distance runners were only granted eligibility to compete in two athletic seasons during the calendar year. Moreover, collegiate distance runners are unable to successfully chase the four rabbits represented by their conference meet, their district qualifying meet, the NCAA Championships, and the USATF National Championships during the outdoor season. The most exciting thing in track and field to happen recently in the United States was the “David versus Goliath” competition of high school athlete Alan Webb against collegiate and world class athletes in the 2001 Prefontaine Classic that resulted in Jim Ryun’s high school mile record being broken. Elite collegiate athletes are those who have developed to national class. In truth, the NCAA qualifying marks are nearly the same as those for the USATF National Championships. This redundancy undermines athletic development. The author believes that the quality of the sport would be elevated, and public interest greatly enhanced by combining the NCAA and USATF National Championships.

Base Period Training Prescriptions

The training conducted during the base period should be individualized for athletes having different backgrounds and levels of ability. However, a micro-cycle or weekly training prescription for the base period during the cross-country and track seasons is provided below.

Monday	Passive Recovery
Tuesday	3/4-effort, Anaerobic Threshold Steady-State
Wednesday	Active Recovery
Thursday	1/2-effort, Fartlek + Date Pace
Friday	Active Recovery
Saturday	3/4-effort, Steady-State
Sunday	Easy-effort, Long Run

As discussed in detail in Chapter 1, after two to three weeks of demanding training, athletes need to take a worthwhile break to prevent the onset of residual and chronic fatigue, and also to consolidate the potential created by previous acquisitive work. Further, a controlled time trial at the end of this week will provide a checkpoint with respect to athletic development. The following schedule provides the structure of a micro-cycle corresponding to the worthwhile break.

Monday	Passive Recovery
Tuesday	1/2-effort, Fartlek + Date Pace
Wednesday	Active Recovery
Thursday	Easy Recovery
Friday	Day Before Race Routine
Saturday	Time Trial or Race
Sunday	Easy-effort, Long Run

Obviously, the selection of various days of the week for particular training tasks is somewhat arbitrary. Most important is the pattern and balance of the training being conducted.

Progression of Training Quality

Monday is normally a day of passive recovery with respect to running. It follows the steady-state at 3/4-effort on Saturday, and the long endurance effort on Sunday. The body has a great need to restore muscle glycogen after two days of high caloric expenditure. Sometimes, a complete day off is best, especially in the case of young athletes. Exercise in the form of recreational biking or swimming could also be done. Monday is a preferred day for one of the two or three weight training sessions normally conducted during the week. Any running should have minimal duration and effort, even for mature athletes. After all, Monday is the day of the week that most people are a bit out of whack. Much of this has to do with the weekend's disruption of regular activity cycles, otherwise known as the weekly regime. We owe a certain debt to that regime, as those who have suffered from chronic disruption of daily activity and circadian rhythms can attest. The harmonious movement of biorhythms relates to the question of athletic acquisition, and more generally speaking, to physical and mental health. So, if it can be helped, do not plan demanding running workouts on Monday, especially if you are dealing with a large group of athletes who will necessarily be in different places physically and mentally after the long weekend. Again, both in terms of the quantity and quality undertaken, Monday should be the easiest day of the week. Athletes need one day a week to freshen up in order to better handle the demanding training efforts.

Tuesday is devoted to an anaerobic threshold session conducted at 3/4-effort. The anaerobic threshold session should be reduced about 20% from the duration of the evenly paced steady-state to be conducted on Saturday. If there is a trade off to be made between quantity and quality—for example, either covering six miles at 6:00 minutes/mile pace in the quality workouts and alternately, 10 miles at 7:00 minutes/mile pace during the recovery days, or 10 miles at 6:00 minutes/mile pace in the steady state and six miles at 7:00 minutes/mile pace on the recovery days—then the latter option is preferable, since more work is being done. On days devoted to high quality training sessions, it is generally best to attempt a longer duration than to break it up into two workouts.

In time, the distance or duration of the Tuesday session will increase, and the athlete will be capable of running the entire workout at a faster pace while

maintaining the same level of effort. Perhaps the most important aspect to focus on concerns the duration, frequency, and intensity of the surges within the anaerobic threshold session. In the first week of a two-to-three-week meso-cycle, begin with a relatively high number of shorter segments, then in succeeding weeks gradually increase the distance, while reducing the number and the frequency of the recovery periods. After taking a regenerative worthwhile break at the end of this first meso-cycle, athletes might begin the next meso-cycle by dropping back down to segments nearly as short as those conducted at the beginning of the first cycle, and then proceed with a like progression over a period of weeks.

It is possible to combine short fast segments, and also long slow segments within a given workout, but rather than complicate this presentation, it is presumed that you have already grasped the larger principle. At some point, the length of the surge segments can progress to encompass the duration of a middle distance event. In fact, given a group of middle distance runners, make sure that the anaerobic threshold sessions progress so as to attain and focus on the duration of the middle distance event during the base period, since the athletes will then condition body and mind to later put forth a hard effort over the main race event. In the case of young athletes preparing for 5,000 and 10,000 meters, limit the surges to three to five minutes duration. However, by the end of the base period, elite athletes competing in international cross-country or the marathon may run 3-4 x 5,000 or 2 x 10,000 meters in training to good effect.

Some coaches and athletes also jump all the way up to the distance or duration of the race event and conduct a time trial, then gradually increase the pace over a span of weeks and months (Lydiard, 1970, and Lydiard and Gilmour, 1962). This is fine for mature athletes in a high level of fitness, provided they are running over demanding terrain. However, for a less fit or novice athlete, this might be like trying to carve marble with a large, blunt chisel, when a smaller, sharper instrument could be used to better effect.

Wednesday and *Friday* are both days of active recovery. The anaerobic threshold steady-state, and the evenly paced 3/4-effort steady-state sessions on Tuesday and Saturday are clearly exhausting, and in some sense the hard-day, easy-day rule is being applied. Some athletes tend to muddle up their training and not sufficiently differentiate between high quality training efforts and recovery efforts. Know when to work hard, but also know when to permit your body to recover. Whenever possible on recovery days, mature athletes should undertake a morning run lasting between 10 and 25 minutes. Young high school athletes should waive this requirement, while more mature high school, collegiate, and post-collegiate athletes should cover up to 25 minutes. When athletes undertake two workouts each day during the sharpening and peak periods, it is generally inadvisable to run beyond this duration in the morning, because doing so could trigger an alarm reaction, causing the central nervous system and endocrine system to become over-activated. As a result, the primary workout could suffer due to the athlete's inability to fully recover by the afternoon training session.

To facilitate recovery, the morning training session should include an easy jog with a few easy short accelerations, and also some mild stretching. In lieu of the above, alternate forms of exercise such as biking or swimming are also appropriate. The top priority is to get the metabolism going, since this will provide a faster rate of recovery. Athletes often feel the most sore and sluggish during the morning session since the metabolic by-products of the previous day's high quality effort frequently induce something of a hangover. However, the afternoon training session will be a more pleasant experience as a result.

The afternoon training session on active recovery days should begin with light stretching followed by a good warm-up, then more thorough stretching. In fact, this is a healthy training practice every day. If possible, conduct the warm-up by running barefoot on grass. If a circuit or weight-training session is included, it should then follow directly. Ideally, the active recovery run should be performed over soft rolling terrain, and incorporate some easy short accelerations. A few short hills on a gentle grade can also be included at moderate effort. Barefoot running on grass is desirable during the warm-down, and flexibility exercises should conclude the active recovery workout.

Over time, the duration and pace of the active recovery run will improve, but this is incidental to overall athletic development. The major objective of the Wednesday and Friday active recovery sessions is to help athletes recover in preparation for the high quality training efforts that follow directly—no more, and no less. Make sure that the runners are not attempting too much, too fast—that is, make sure they are recovering! Heart rate monitors can be used to good effect as a governor on quality. Attempt to introduce some variety, and if at all possible, seek out a restorative natural environment.

Thursday's training session of unstructured 1/2-effort fartlek, comes between the 3/4-effort anaerobic threshold steady-state workout on Tuesday, and the 3/4-effort evenly paced steady-state session that follows on Saturday. This schedule provides three to four days for recovery between these two 3/4-effort training sessions. The fartlek workout should be as demanding as possible, but easy as necessary, so as to avoid compromising the quality of either of the two 3/4-effort training sessions. The fartlek format is well suited to serve as a safety valve, since the training structure and effort can be modified according to circumstances at the runner's discretion. The fartlek session should incorporate hilly or otherwise resistant terrain, thus ensure that requisite levels of strength are maintained.

The Thursday training session should also include some date pace work. It is desirable to gradually progress the date pace work to ensure an injury free transition when the sharpening period begins. This will also foster running economy. Athletes specializing in 800 and 1,500 meters are best advised to undertake a brief interval session with reps in the range of 100 to 200 meters, whereas specialists in the 5,000 and 10,000 meters can conduct a brief interval session with reps in the range of 200 to 400 meters. However, at this time, runners should always take ample recovery periods, since the aim of date pace work is not to sharpen for race fitness.

This brings up a question concerning the proper progression of date pace work over the course of an athletic season. The sharpening period will incorporate interval and repetition work at goal pace for the main race event, and will begin approximately five to six weeks prior to the first projected optimal performance during the peak period (Approximately 28 to 33 days of sharpening, plus the nine-to-10-day ascent to the plateau of peak performance = 37 to 43 days). In the meso-cycle immediately preceding the sharpening period, the date pace work should be conducted at goal pace plus one second/400 meters. Likewise, the quality of the date pace work performed in the next preceding meso-cycle should be at goal pace plus two seconds/400 meters, and so on. In short, the date pace work should be increased by one second/400 meters in each consecutive meso-cycle preceding the start of the sharpening period.

In order to attain goal finishing speed during the peak period, a finishing speed progression should be conducted, especially by middle distance runners. The date pace workout formerly conducted on Thursday is then transformed into a finishing speed workout during the sharpening period. Each succeeding week, the number of reps in the range of 100 to 200 meters in the finishing speed progression decreases, but the quality and speed of the reps should increase such that by the end of the progression, three reps between 100 to 200 meters are being run at goal finishing speed. Obviously, long distance runners having a closing speed of 56 seconds over 400 meters do not need a lengthy finishing speed progression. However, athletes competing in the 1,500 meters who need to close in 52 seconds, with the last 200 meters being run under 25 seconds, have a greater need. In this regard, it would not be prudent to progress in only five to six weeks from a goal pace of 59 seconds in the main race event to an exhibited goal finishing speed corresponding to an open 400 meters performance of 49 seconds. Accordingly, individuals competing in the 800 and 1,500 meters should begin their finishing speed progression at the end of the base period. This can take the form of running brief acceleration exercises during the warm-up and warm-down, several times during the week, and some occasional race practice. The essential point is that a foundation of finishing speed work should be provided, or athletes will either not be able to progress to the desired quality, or will get there by assuming too high a risk of injury. Unnecessary risk-taking in a sport with a ten-year developmental period, must be viewed as conducive to a negative outcome. An athlete does not play the odds and win in distance running. It is best to strive towards eliminating any so-called luck or chance from the equation. For detailed date pace and finishing speed progressions see in Chapter 4, Figures 4.2—4.7, and Tables 4.1—4.4, respectively.

Saturday is devoted to conducting an evenly paced 3/4-effort steady-state effort. This will serve to consolidate the potential created by the anaerobic threshold steady-state training session four days previous. At the halfway point of a 3/4-effort workout, an athlete will often have doubt as to the task's completion, but the training session will nevertheless be successfully concluded. It is natural and normal to experience these doubts. Do not attach to them, rather, simply let them pass by in the stream of consciousness.

Some coaches and athletes might seek abstract guidance with respect to predicting the pace at which the steady state effort should be conducted. In this regard, they may wish to study Table 3.2 and Figure 3.3 found in Jack Daniel's fine work entitled *Daniel's Running Formula*, 1998. However, do not become too distracted with trying to determine what abstract level of intensity is correct for you. In truth, there are as many different correct levels of intensity as there are different individuals on a given day. And even the same individual will not be the same from day to day. It is not uncommon for the pace of the steady state run to vary from one week to another by as much as ten or twenty seconds / mile depending upon how an individual feels, and also the environmental conditions. Whether you are a coach or an athlete, the judgments made concerning the distance and pace of the steady state run are not abstract. The training prescription does not suddenly materialize out of the ether. Pay close attention to circumstances. What distance an athlete has covered previously, and at what pace normally provides the most relevant point of reference.

In truth, the correct intensity for the steady-state runs is easy to figure out. You run as hard as you can at a relatively even pace to cover the desired distance--bearing in mind that you need to be adequately recovered in time for the next 3/4 effort planned three or four days later. If you try for too much your body will let you know. You'll slow down over the second half of the run, or perhaps even have to walk home. "No worries." If that is the biggest mistake you make in Athletics or life, then you're a candidate for sainthood. Do not go out and run at an even pace at some abstractly defined level of intensity on asphalt like a robot. In particular, do not run as if you were an automobile set on cruise control. Whenever possible, run on natural terrain, as this necessarily requires that you maintain a high level of concentration and focus. It will also cultivate subtle variations in your running technique which can significantly enhance your running economy. (See the discussion in Chapter 16).

Moreover, do not underestimate the importance of mental fitness, and conducting race practice even during so-called evenly paced steady state runs. For example, let's say that we have two individuals of equal talent who conduct a steady-state run over a given course and log the same time. One runs at an even pace, and socializes with training partners. The second runs alone, and brings back the second half of the run a bit faster than the fist. And when there is a hill, he picks the pace up. When there is a headwind, he increases his effort. He visualizes competitors on his shoulder. He hears the little voice of temptation say: "Maybe you won't make it... it's OK to slack off a bit" (Elliott, in Meads and Armstrong, 2000). Disgusted at having heard the "little voice," he picks the pace up. With a mile to go he further increases his speed, and with half mile to go—even faster. Then, with four hundred meters to go... he's mentally running the last lap of the biggest race of his life. He finishes past a lamppost as if hitting the tape. Come race day, this second individual will defeat the first by a wide margin.

Over the span of weeks and months, the distance of the steady-state run should be gradually increased. As athletes become more fit, the pace of the training session will also improve when performing at 3/4 effort. In order to monitor progress, it

can be helpful to run the steady-state over the same course from time to time, as this will provide a point of reference. The athletes should then merely run at 3/4 effort and note the final result, and guard against turning this progress report into a race. Unless runners are just beginning to train in earnest, they should not expect dramatic improvement from one day to the next, or week-to-week. Improvement is the result of a gradual process that unfolds naturally over months and years. Athletes might have moments of doubt, but they should have faith in themselves and their training, as deeper currents are at work, making steady progress. The direction will be clear when dedicated athletes take a longer look at their training diaries.

Sunday is the longest aerobic training session of the week, and young athletes should always run at a relaxed and easy pace, at less than 1/4-effort. However, mature athletes specializing in the long distance events such as 5,000 and 10,000 meters and the marathon, generally should conduct the Sunday long run at approximately 1/2-effort. This will enhance the ability of the athletes to use fatty acids, as discussed in Chapter 16, devoted to the marathon. The Sunday run also serves as the pathfinder to higher quantity with respect to distances being covered in the individual training sessions during the week. Athletes need to be cautioned to recognize and respect their limitations. In particular, athletes should not go on a binge on Sunday that will knock them flat and compromise the quality of the Tuesday 3/4-effort anaerobic threshold steady-state session. That would not be intelligent or productive. The primary aim is to gradually increase the distance of the long run, but athletes will also find themselves running at a faster pace. The latter should not be striven for, rather, it should just happen.

The requisite level of concentration during more intense training can render athletes semi-oblivious to their surroundings. Athletes should then take care to absorb some of their environment on Sunday, and notice the people and things that normally go by in such a rush. Otherwise, they might look back someday with regret over how much they have missed. Sunday used to be sacred—that is, prior to the invention of football and shopping malls—and it could be that our spiritual needs and limitations were once better observed.

Progression of Training Quantity

It makes little sense to sacrifice quality in favor of quantity. Nevertheless, the tendency is for athletes to play the numbers game with respect to their mileage. Often this is because they do not know what they should be trying to accomplish with respect to quality. And so athletes become obsessed with quantity, as the math is simple and it is something that they do understand. Accordingly, the so-called logic goes, “if so-and-so runs x miles a week, then I must too, and it would no doubt be better to run x + 10 miles a week if I could.” If athletes do not know any better, they may sleep well having written “X miles this week” in their training diaries. But it makes no sense to run high mileage just for the sake of doing it, and without an intelligent approach.

Athletes should start with relatively low mileage, and in the first weeks run only to cover the distance, then in following weeks introduce the desired quality. Only when they are running a given level of quantity at the desired quality should

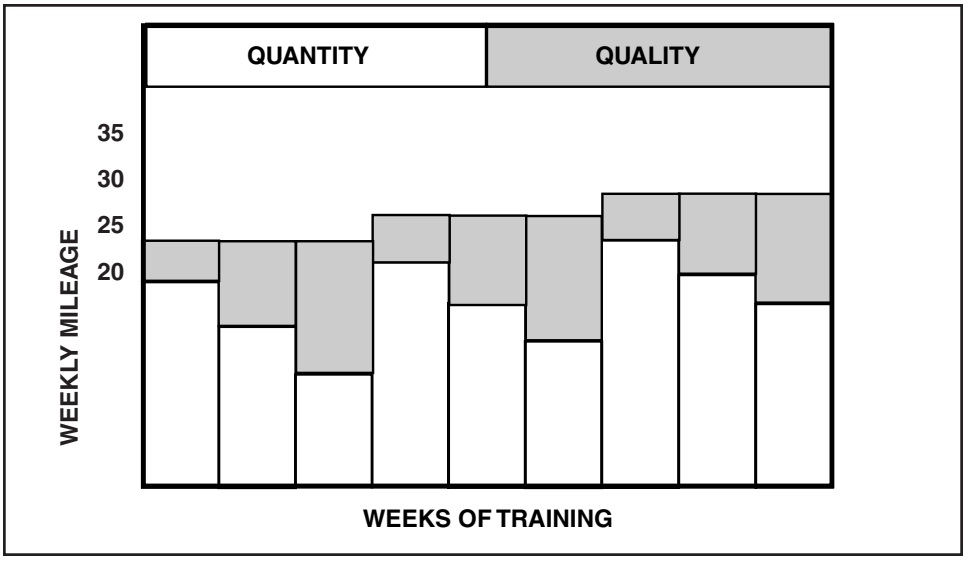


FIGURE 2.12

they again increase their mileage. The athletes should then start all over and merely run to encompass the new level of quantity, then gradually introduce the desired quality until this new level of training is absorbed. If the requisite cycles of acquisition and training periodization are momentarily set aside, the progression of quantity and quality will appear as indicated in Figure 2.12.

Obviously, the more mileage athletes attempt, the longer it will take to assimilate that new level and introduce the desired quality. This is particularly true when athletes are introduced to distance running for the first time. The initial acquisitive effort is always the most costly, both physically and mentally. Again, the ability of the athletes, and their stage of development must always be kept in mind. In order to realize a quantum leap in performance with young athletes, the easiest thing to do is to rapidly increase their mileage. However, long-term development is far more important, so it is best to err with leniency on the side of quality. After a respite from training, mature athletes will be able to reintroduce quantity and quality faster, and with less distress than their younger counterparts. So in some sense it is true: once athletes have done the acquisitive work, they can return to a previously attained level much easier, albeit, it is never truly easy.

It is best to first attempt a given level of weekly mileage in the afternoon training sessions, then gradually introduce easy two-to-four-mile morning runs on the recovery days. In this way, the total mileage can be bumped up to the next level without compromising the desired quality. Now, having attained the desired weekly mileage and quality, via the introduction of morning sessions, athletes are ready for the next level of quantity. For example, if athletes run 35 miles/week in the afternoon workouts and gradually introduce the desired quality, but also five auxiliary morning runs of two miles during the week (35 + (2 x 5) = 45 miles), they would then proceed to the next level of quantity, that is, 45 miles/week, while dropping the auxiliary morning workouts, and then begin the acquisitive cycle all

over again. This method provides for gradual transitions of quantity and quality. In keeping with the micro-cycle or weekly training schedule that has been discussed, Table 2.3 provides a progression of quantity over weeks, months, and years of training.

Meso-Cycle Structure of the Base Period

The first training meso-cycle during the base period will be characterized by relatively low intensity and volume. The primary goal is to gradually build up the training volume over a period of several weeks. Reasonably fit young athletes who are not long out of regular training can normally undertake 21 to 28 days of low intensity base work before needing an easy worthwhile break. The second meso-cycle during the base period would then continue to increase in volume, but the focus would then shift towards introducing the desired quality within the base work. This second meso-cycle normally lasts between 14 and 21 days before a worthwhile break is required. Again, as the intensity and effort of the work increases during the course of an athletic season, the length of the training meso-cycles become shorter. A third meso-cycle conducted during the base period would then likely include only 14 days of work followed by a worthwhile break, and this would be the pattern thereafter during the base period.

However, pay close attention to the actual level of effort and response of the individual athlete. If and when the warning signs appear, indicating the need for a worthwhile break, then it should be taken. At the end of each worthwhile break, athletes should conduct a control run or time trial. Sometimes, a road race can be used for this purpose. Table 2.4 indicates the recommended length of the first, second, and possible third control run for athletes competing in various main race events.

Miles per week	25	35	45	55	65	75	85	95	105	115
M	0	2	2	3	4	4	5	6	6	7
T	4	6	7	8	10	12	14	15	16	18
W	3	4	6	7	8	8	9	10	12	13
TH	4	6	7	8	9	10	12	14	16	18
F	3	4	6	7	8	8	9	10	12	13
SA	4	6	8	10	12	14	16	18	20	20
S	6	8	10	12	15	18	20	22	24	26

TABLE 2.3

Main Race Event (Meters)	800	1,500	5,000	10,000
1st	5K	10K	15K	20K
2nd	3K	5K	10K	15K
3rd	1,500	3K	8K	10-12K

TABLE 2.4

Figure 2.13 shows a training progression of quantity and quality for young athletes over two succeeding meso-cycles. Mature athletes normally assume higher training loads, and progress to higher levels of quantity and quality at a faster rate. They also require more numerous and frequent meso-cycles to realize optimal athletic development. Figure 2.14 shows a progression of quantity and quality for mature athletes over three succeeding meso-cycles.

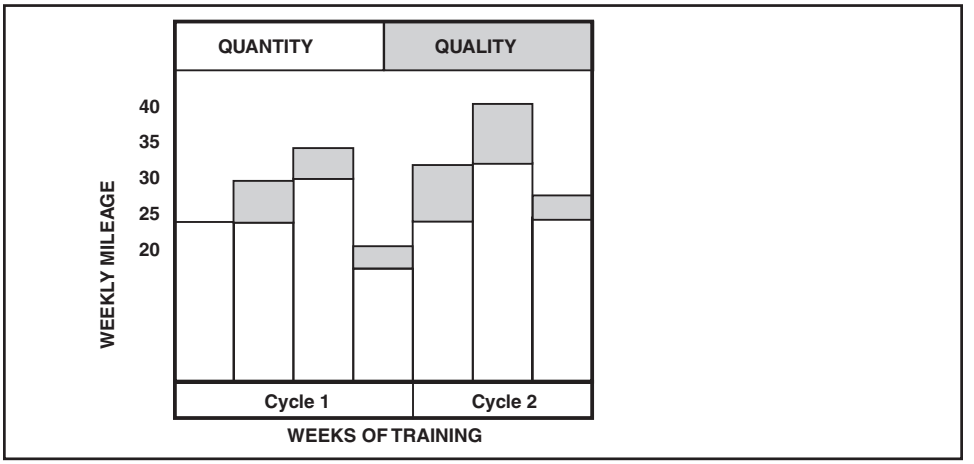


FIGURE 2.13—Young Athletes.

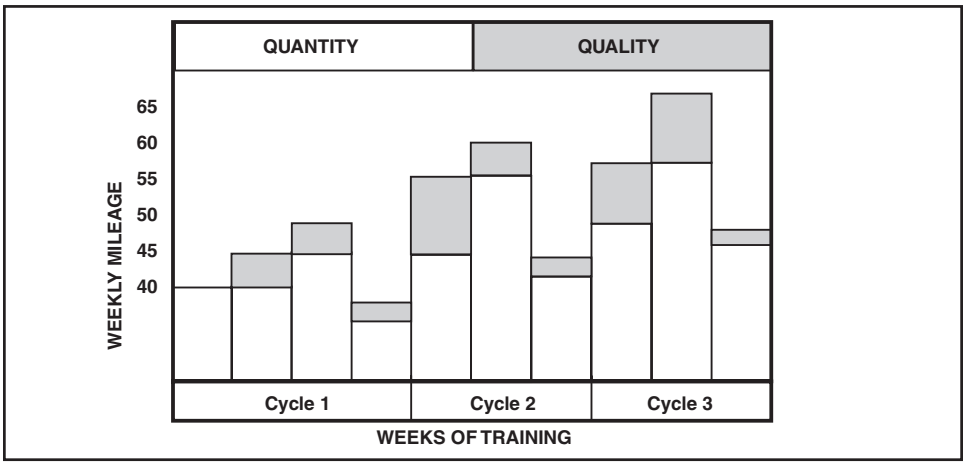


FIGURE 2.14—Mature Athletes.

Heart Rate Response Characteristics

As athletes adapt to training during the course of an athletic season, certain changes in heart rate response will be noted. Let's suppose an athlete started the season with a morning resting pulse of 50 beats per minute (bpm). The morning after a 3/4-effort workout the morning pulse will normally be elevated at least one bpm, more commonly by two, and possibly even three. And so the morning pulse will then likely be 52 bpm. If the morning pulse rises over three bpm, then the athlete may be overtraining. If an athlete's morning pulse remains high on the day of the next planned 3/4-effort workout, reassess the training schedule. The morning following a day of easy active recovery, the athlete's pulse should then recover back to the original baseline of 50 bpm. During the course of any given meso-cycle, the morning pulse will commonly fluctuate between one to three bpm above the original baseline value, and will then return to the baseline value. However, at the end of a worthwhile break, something dramatic normally happens. The morning pulse rate will often drop about two to three bpm, say from 50 bpm to a new level of 47 bpm. That new baseline will then characterize the next meso-cycle, that is, with the morning pulse rising after hard efforts and returning back to normal after recovery days. At the end of that cycle, after taking another worthwhile break, the morning pulse will again drop by about two to three bpm. It is common for an athlete's morning pulse to drop 10 bpm during the course of an athletic season (for example, from 50 to 40 bpm). Obviously, the amount of change will depend on the individual's age, training background, and athletic level.

At the same time, a similar phenomenon occurs at the opposite end of the spectrum with respect to the athlete's heart rate deflection point at the anaerobic threshold, and to a lesser degree, the maximum heart rate. It is not uncommon to see an athlete's deflection point move upwards 3 bpm by the end of the worthwhile break following the first meso-cycle, for example, from 165 to 168 bpm, then from 168 to 171 bpm after the second, then 171 to 174 bpm after the third, and so on. Accordingly, improvement of an athlete's fitness level is normally reflected in the heart rate response characteristics at both ends of the spectrum. Again, the actual heart rate response of different individuals can vary greatly.

Progression of Training Volume by Age, Sex, Athletic Level, and Event

The following abstract training guidelines in no way account for the unique needs and requirements of individual athletes, but rather, indicate the maximum mileage that runners should attempt to undertake. Many individuals may find that they do well with less volume. However, athletes should not be in denial regarding the workloads commonly required to succeed at these levels of athletic competition.

High School Cross-Country

Young female high school athletes competing in cross-country might begin in the low teens, and by the end of their sophomore year be capable of running 30 to 40 miles a week. By their senior year, 40 to 50 miles a week could be possible.

Young male high school athletes might similarly begin in the low 20's, and by the end of their sophomore year be capable of handling 40 to 50 miles a week. By their senior year, 60 to 70 miles a week could be assumed.

High School Track and Field

Mature female high school athletes competing in the 800 meters can normally attempt 30 miles, whereas, those competing in the 1,500 and 3,000 meters can attempt 40 to 50 miles a week by their senior year. Mature male high school athletes competing in the 800 meters can normally attempt 40 to 50 miles, whereas, those competing in the 1,500 and 3,000 meters can attempt 60 to 70 miles a week by their senior year.

Collegiate Women Cross-Country and Track and Field

Collegiate women participating in cross-country could progress from 50 to 90 miles per week over a four-year period. Collegiate women specializing in the 800 meters event might progress from 30 to 70, specialists at 1,500 and 3,000 meters from 40 to 80, and specialists at 5,000 and 10,000 meters from 50 to 90 miles a week over four years.

Collegiate Men Cross-Country and Track and Field

Collegiate men participating in cross-country could progress from 60 to 100 miles per week over four years. Men competing in the 800 meters event might progress from 40 to 80, specialists at 1,500 and 3,000 meters from 60 to 90, and specialists at 5,000 and 10,000 meters from 70 to 100 miles a week over four years.

Elite Women Cross-Country and Track and Field

Elite women competing in international cross-country or the marathon could progress from 90 to 120 miles per week over four years. Women competing in the 800 meters might progress from 70 to 100, specialists at 1,500 and 3,000 meters from 80 to 110, and specialists at 5,000 and 10,000 meters from 90 to 120 miles per week.

Elite Men Cross-Country and Track & Field

Elite men competing in international cross-country or the marathon could progress from 100 to 140 miles per week over four years. Men competing in the 800 meters might progress from 80 to 110, specialists at 1,500 and 3,000 meters from 90 to 120, and specialists at 5,000 and 10,000 meters from 100 to 140 miles per week.

In conclusion, a distance runner must be willing to log thousands of miles and dedicate many years to achieve success at the international level. Accordingly, the pursuit of excellence in distance running is not for the faint of heart or spirit. If you don't experience fear or doubt at some point, then you are not alive.

Every morning in Africa a gazelle wakes up. It knows it must outrun the fastest lion or it will be killed. Every morning, in Africa a lion wakes up. It knows it must run faster than the slowest gazelle or it will starve. It doesn't matter whether you're a gazelle or a lion: when the sun comes up, you had better be running.

—Sheikh Mohammed Bin Rashid Al Maktoum

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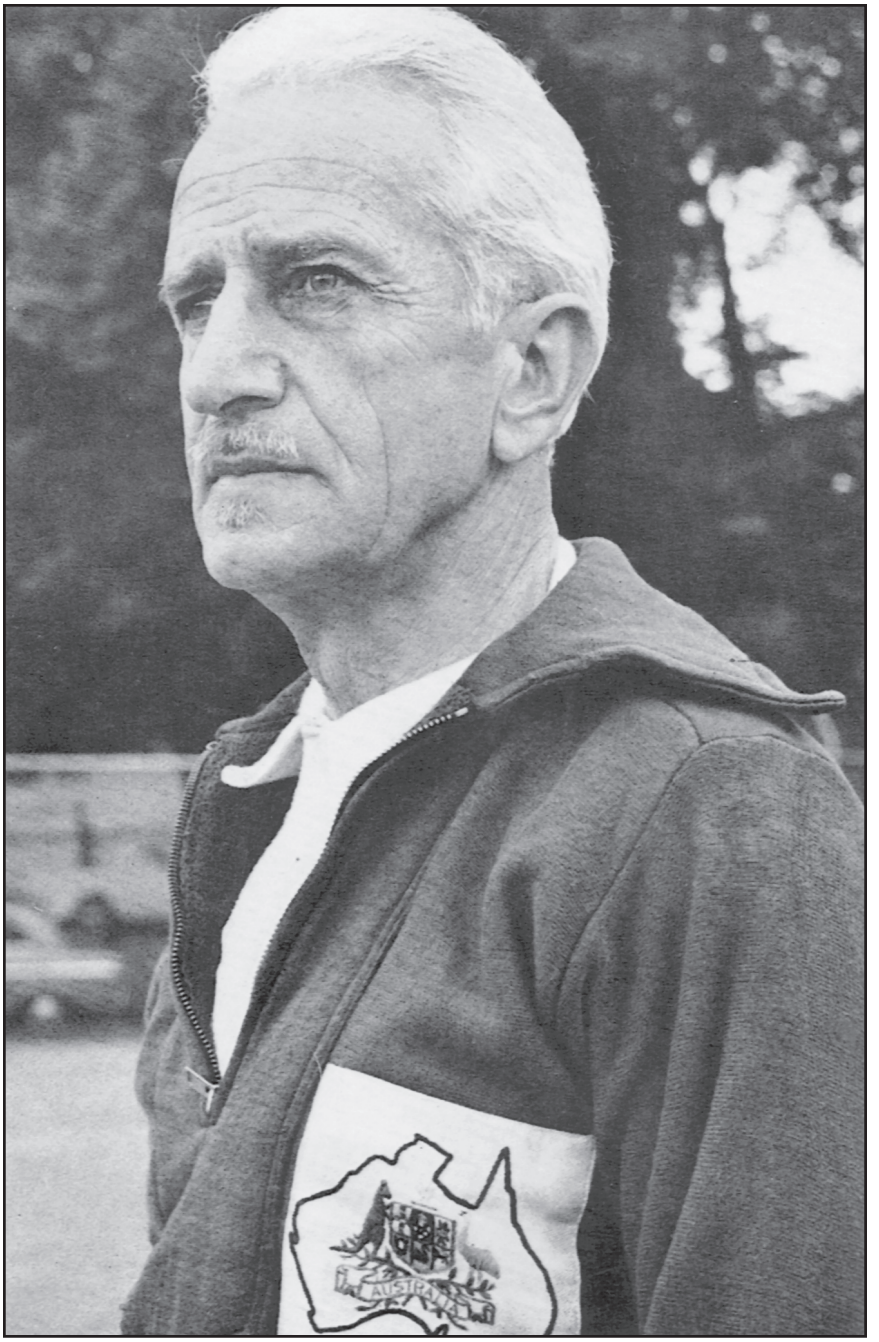

PHOTO 3.1—Percy Cerutty, the controversial and inspiring coach who contributed to the golden age of Australian distance running. Photo by M.A. Stratton, from the title page of *Athletics: How To Become a Champion*, London: The Sportsmen's Book Club, 1961, and provided courtesy of Nancy Cerutty.

CHAPTER 3

The Hill Period

The hill period can comprise a distinct training period, but it often takes the form of a training emphasis. This is especially true during the cross-country season, since the nature of the terrain requires considerable specificity of training. When the mileage assumed by the athletes has progressed to a prudent ceiling for the current season, the introduction of hill work can also enhance the quality of their training while simultaneously slowing the pace of the workouts. It can thus prevent the athletes from unwittingly sharpening and accelerating the peaking process. Accordingly, it can be doubly advantageous for elite athletes to train at altitude for at least three weeks at the end of the base and hill periods. The combination of supra-normal training loads provided by the altitude and hill training can elicit substantial improvement in performance potential.

An important aspect of fitness is developed when athletes train near their anaerobic threshold while simultaneously applying muscular strength to overcome the resistance of a supra-normal training load. All other things being equal, athletes who have cultivated greater aerobic ability and strength by incorporating hills or other resistance work in their running program will exhibit less blood lactate accumulation given a sub-maximal work load. Moreover, the athletes will be able to exercise longer while maintaining a higher equilibrium blood lactate level, and their anaerobic threshold will comprise a relatively higher percentage of their maximum oxygen uptake.

Arthur Lydiard advocated up to five weeks of hill training, and noted that within six weeks every Type II fast twitch muscle fiber cell in the body is renewed (Lydiard and Gilmour, 1962, and 1978). During the base period, athletes focus developmental efforts on the aerobic pathway, and predominantly the Type I slow twitch muscle fiber metabolism associated with endurance. Then, during the hill period, the athletes stress the foundation of the anaerobic systems, that is, the Type II fast twitch muscle fiber metabolism associated with speed and strength. The work conducted during the sharpening period then serves to integrate, coordinate, and translate these acquired powers into specific performances during the peak period.

One of the visible physical effects of hill training is a longer and more powerful stride. In particular, the knee-lift, ankle flexion, and hip extension demonstrated by athletes will improve. Speed flows from strength, and one of the aims of the hill period is to enhance muscular strength in preparation for the subsequent sharpening work. Athletes will also obtain the durability required to avoid injury.

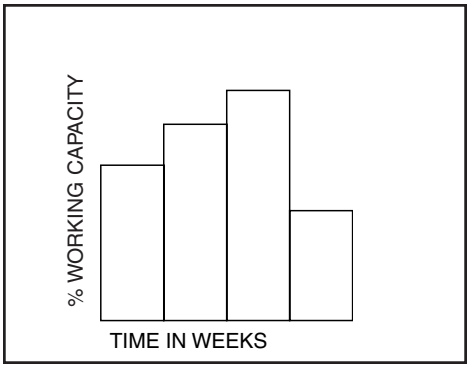

FIGURE 3.1

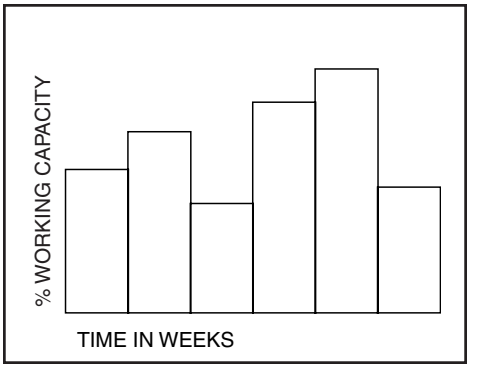

FIGURE 3.2

Meso-Cycle Structure of the Hill Period

The following discussion will address the meso-cycle structure of the hill period. When Arthur Lydiard suggested five weeks of hill work, people generally inferred that this should be conducted in a continuous five-week training block. However, this would generally constitute a training overload. It is not advisable to conduct more than three consecutive weeks (21 days) of hill work without taking an easy week or worthwhile break. Obviously, meso-cycles lasting less than three weeks can be conducted without hazard, given the adoption of sound training practices. For example, it is possible to conduct seven, 10, or 14 days of hill work prior to taking an easy week. Again, the worthwhile break normally concludes with a control run, time trial, or athletic competition that stabilizes and consolidates the runner's athletic level. The meso-cycle indicated in Figure 3.1 can be described as a hill period lasting for a total duration of four weeks, including three progressive workweeks of hill training followed by an easy week or worthwhile break.

To avoid confusion when discussing the various hill training scenarios, this text will always refer to the total number of workweeks. The possible desire to conduct more than one time trial, control run, or athletic competition over the duration of a month generally leads to the construction of a hill period comprising two consecutive meso-cycles. At an absolute maximum, the total duration of the hill period, including these two meso-cycles, should not exceed six weeks. For example, two weeks of hill work might be followed by a worthwhile break, and conclude in an athletic competition. Then, two additional weeks of hill work would follow, and a second easy week or worthwhile break would conclude in a second athletic competition, as shown in Figure 3.2.

Figure 3.2 illustrates a hill period having a total duration of six weeks, including four weeks of hill work and two worthwhile breaks. It is not advisable to conduct more than six weeks of focused hill training, and generally, four weeks will provide optimal results for high school and collegiate athletes. In the United States, novice high school athletes (or those whose physical age corresponds to that of a freshman or sophomore) would not likely begin base work until the first day of organized cross-country team practice in mid-August. These athletes

would then not begin base work for the spring track and field season until the start of organized team practice in the first week of March. Generally, they would enjoy a relatively short athletic season, as few will normally be competing after their conference championships. Since they have an abbreviated season and no pre-season training, novice athletes can make best use of the available time by conducting base work. They should generally avoid demanding hill training sessions for which their relatively immature bodies are ill prepared. With reference to the cross-country and track and field seasons, they are generally best advised to proceed with easy base work for the better part of the athletic season, and should then conduct only three weeks of sharpening work prior to the beginning of the peak period.

In the United States, the more mature high school athletes (those whose physical age corresponds with the average junior and senior) can be expected to begin a pre-season training program of base work for the cross-country season in the first week of July. This provides for a month of post-season recovery after the conclusion of the outdoor state track and field championships, normally held in late May or the first week of June. Following the state cross-country championships, normally held in the first week of November, another extended period of post-season recovery should be taken. However, if high school athletes also qualify and compete in the national cross-country championships, then their athletic season could be extended until December. In any case, at least a month of post-season recovery should be taken between the cross-country and track seasons. The more mature high school athletes would then commence pre-season training for the track season by mid-January. Given their more extensive preparation, they will normally be able to conduct three to four workweeks of hill training during the cross-country and track and field seasons. For example, three workweeks could be followed by a worthwhile break, or four workweeks could be broken up into two meso-cycles which end in worthwhile breaks, but all within a hill period lasting a total of four to six weeks.

Collegiate athletes in the United States face a challenge when participating in three competitive athletic seasons. The summer provides the only time for extensive base work for athletes who are expected to compete well during the cross-country, indoor, and outdoor track seasons. Given the proximity of the indoor and outdoor track seasons, it would only be possible to undertake a hill training period during the fall cross-country season. Nevertheless, a hill training emphasis could be included within the base period during the build-up for the track and field seasons. Again, an athletic year consisting of two athletic seasons is far better for athletic development than one including three athletic seasons. Because of this, coaches and athletes are generally best advised to de-emphasize or train through the indoor season to realize optimal performances during the outdoor track and field season. In this case, it would be possible to undertake distinct hill periods in preparation for both the cross-country and outdoor track and field seasons.

Depending on their body type and relative strengths, individual athletes can benefit by placing greater or lesser emphasis upon hill training. Physically weaker

athletes generally benefit from a longer hill period. For this reason, collegiate women should normally assume three to four workweeks of hill training, and if need be, at the expense of a week of sharpening work. Accordingly, mature high school boys and collegiate men normally undertake three workweeks of hill training and four workweeks of sharpening, whereas women often assume four workweeks of hill training and only three workweeks of sharpening during an athletic season.

With particular reference to the cross-country season, three to four workweeks of hill training and only three workweeks of sharpening is advised for both genders, since the terrain and expected weather conditions will test their strength. This prescription can also apply to long distance runners who conduct relatively high quality base and hill work. However, with respect to middle distance athletes, competitive requirements normally dictate more extensive hill training and sharpening work. Accordingly, mature specialists at 800 and 1,500 meters can often, to good effect, assume a hill period lasting a total of six weeks, comprising four workweeks and two worthwhile breaks. However, to go beyond this duration could result in diminished returns, because other aspects of fitness would then be sacrificed.

Transitions and the Hill Period

A number of common questions arise concerning the transition from the base period to the hill period. For example, how much should an athlete's training-volume or mileage decrease? Due to the more exhaustive nature of the hill work, the training volume should normally decrease in mileage relative to that attained during the previous base period. Just how much of a reduction depends on a number of things, including the athlete's event, age, sex, and athletic level. The following guidelines may help:

The specialist at 10,000 meters should reduce volume by 10 to 15%. Thus, if the athlete had attained 100 miles per week in the workweeks during the base period, the athlete would drop down to about 85 to 90 miles per week during the workweeks in the hill period.

The specialist at 5,000 meters should reduce volume by 10 to 15%. Thus, if the athlete had attained 85 to 90 miles per week in the workweeks during the base period, the athlete would drop down to about 75 to 80 miles per week.

The specialist at 1,500 meters should reduce volume by 15 to 20%. Thus, if the athlete had attained 75 to 85 miles per week in the workweeks during the base period, the athlete would drop down to about 65 to 75 miles per week.

The 1,500-meter sided 800-meter specialist should reduce volume by 20 to 25%. Thus, if the athlete had attained 65 to 75 miles in the workweeks during the base period, the athlete would drop down to about 55 to 60 miles per week.

The 400-meter sided 800-meter specialist should reduce volume by 25 to 30%. Thus, if the athlete had attained 50 to 60 miles in the workweeks during the base period, the athlete would drop down to about 40 to 45 miles per week.

Another question concerns just which training elements are retained, and which are dropped during the hill period? Essentially, in the present training

prescription, the Sunday long run (LR), the Monday passive recovery day (PR), and the active recovery days (AR), placed after the 3/4 and 1/2-effort workouts, remain unchanged.

A 3/4-effort hill circuit then replaces the 3/4-effort Anaerobic Threshold Steady State (ATSS) on Tuesday. This actually represents a subtle change, as the ATSS can also be conducted during the base period on a loop containing a series of hills. However, if more than three workweeks of hill training are to be undertaken, or if the total duration of the hill period (including worthwhile breaks) extend beyond four weeks, it is best to alternate running the ATSS over a hilly route with an evenly paced Steady State (SS) in the Tuesday training session on succeeding weeks. This ensures that an athlete's aerobic ability will be maintained at a high level prior to commencing the sharpening period.

The fartlek workout conducted on Thursday during the base period would then be retained during the hill period, and continue to include date pace work that would progress in quantity and quality. Some finishing speed work could also be introduced on this day, depending upon the athlete's main race event and any special needs and requirements (See Chapter 1 and Chapter 4). A more significant change made during the transition between the base and hill periods, is that a structured hill workout will replace the Steady State (SS) on Saturday.

The changes made in the content of the high quality training sessions during the transition from the hill period to the sharpening period are more dramatic. Once again, little if anything changes with respect to the Long Run (LR), the day of Passive Recovery (PR) or days of Active Recovery (AR). To help maintain aerobic fitness, the athlete should maintain the same volume of training on these days as during the hill period. Nevertheless, the overall net effect will often slightly decrease the athlete's training volume during the sharpening period relative to the preceding hill period. However, during the sharpening period, the 3/4-effort hill workouts on Tuesday and Saturday will be replaced by high quality sharpening workouts. In this prescription, the 1/2-effort fartlek workout on Thursday is retained in order to help maintain the athlete's aerobic ability and muscular strength. The portion of the fartlek workout formerly devoted to Date Pace (DP) work is dropped, since the athlete has progressed to Goal Pace (GP) work during the sharpening period. Instead, after a warm-up and stretching, the athlete will conduct Finishing Speed (FS) work and then conclude the Thursday session with a 1/2-effort fartlek session. Coincidentally, this will help the athlete recover from the preceding finishing speed work.

Cross-Country: Weekly Structure of the Hill Period

The competitive distances in cross-country (3,000 to 5,000 meters for high school girls, 5,000 meters for high school boys and collegiate women, 8,000-10,000 meters for collegiate men, and 12,000 meters for men competing at the international level) place similar demands on athletes who are nevertheless at different levels of development. Table 3.1 provides a typical micro-cycle or weekly schedule for the hill period in which the Tuesday and Saturday sessions can be interchanged.

Again, in order to freshen up and avoid chronic fatigue, after anywhere between two to three weeks of progressive hill training, athletes will require an easy week. At the end of this worthwhile break, a check should be made on the fitness of the athletes by conducting a 3/4-effort control run, time trial, or an actual competition. This also serves to consolidate their new performance potential. Table 3.2 provides a typical schedule for a worthwhile break to set up athletes for a time trial on Saturday.

The coach and athlete should both appreciate how much race performance will be suppressed during the hill period. Peter Snell, a former world record holder at 800 and 1,500 meters, could only run 800 meters in 2:02 during his hill training. However, Lydiard's hill training program was more intensive than anything advocated here. Nevertheless, it can be destructive to an athlete's confidence to compete in the main race event, or for an athlete to expect a level of performance that cannot be delivered at this time. As a rule of thumb, expect performances to be suppressed on the order of at least two seconds/400 meters (thus, four seconds in the 800 meters, eight seconds in the 1,500 meters and 16 seconds in the 3,000 meters).

Track and Field: Weekly Structure of the Hill Period

The hill period for specialists at 5,000 and 10,000 meters during the track and field season is nearly identical to that undertaken during the cross-country season. However, during the track and field season, middle distance runners will focus upon events between 800 to 3,000 meters. Athletes competing in the 800 and 1,500 meters must place greater emphasis on strength development and hill training. The more a given race event requires strength, power, and explosive speed, or the greater the deficiency of athletes in this regard, the greater should be the hill training emphasis. Keep in mind the particular needs of individual athletes and the specific training required for their race events when planning the hill training sessions.

Table 3.3 provides a typical micro-cycle or weekly training schedule for workweeks within the hill period during the track and field season.

Table 3.4 provides a typical micro-cycle or weekly training schedule for worthwhile breaks during the hill period to set up athletes for a Saturday competition. For a detailed discussion regarding the use of time trials to set up athletes for optimal performance in a given race event, see Chapters 4 and 5.

Hill Running Technique

Athletes should perform most of the hill work using their normal running technique, but some variety is good from time to time. For example, the Lydiard style of hill bounding and also skip bounding can sometimes be introduced. However, these forms of bounding are too stressful for novice athletes to safely assume. Even mature men and women can be exposed to a high risk of injury

Monday	Passive Recovery
Tuesday	3/4 Effort, Hill Circuit
Wednesday	Active Recovery
Thursday	1/2 Effort, Fartlek + Date Pace
Friday	Active Recovery
Saturday	3/4 Effort, Hill Workout
Sunday	Easy Effort, Long Run

Table 3.1

Monday	Passive Recovery
Tuesday	1/2 Effort, Fartlek + Date Pace
Wednesday	Active Recovery
Thursday	Easy Recovery
Friday	Day Before Race Routine
Saturday	3/4 Effort, Time Trial
Sunday	Easy Effort, Long Run

Table 3.2

Monday	Passive Recovery
Tuesday	3/4 Effort, Hill Workout
Wednesday	Active Recovery
Thursday	1/2 Effort, Fartlek + Date Pace
Friday	Active Recovery
Saturday	3/4 Effort, Hill Workout
Sunday	Easy Effort, Long Run

Table 3.3

Monday	Passive Recovery
Tuesday	1/2 Effort, Fartlek + Date Pace, or 3/4 Effort, Time Trial in an Under-Distance Event
Wednesday	Active Recovery
Thursday	Easy Recovery
Friday	Day Before Race Routine
Saturday	Race
Sunday	Easy Effort, Long Run

Table 3.4

PHOTO 3.2—Percy Cerutty and Herb Elliott running in the sand dunes at Portsea, Australia. Photo from *Middle Distance Running*, Great Britain: Pelham Books, Ltd., 1964, and provided courtesy of Nancy Cerutty.

with hill bounding. It can be beneficial, but not in the doses originally prescribed by Lydiard. One of his strongest pupils, Peter Snell, apparently came to the same conclusion, as recorded in his athletic memoirs (Snell, 1965).

Hill bounding must be performed on a natural grass or earthen surface, as asphalt surfaces impart high shock loads, and can greatly increase the risk of injury. However, beware of wet or slippery conditions—including loose bark dust, mud, or snow, because these can cause a short, sudden, and apparently minor slip during toe off. This can result in an injury, particularly to the area of the hip joint. The precise location can often be found at approximately the 10 o'clock position when the afflicted athlete stands sideways facing the viewer's right. Perhaps the ideal physical environment for conducting hill training is on sand dunes, as was the practice of the Australian coach Percy Cerutty.

> ***If you die, I will bury you in the sandhills with all the other runners.***
>
> —Percy Cerutty, greeting a visitor to Portsea

If coaches or athletes desire to include another form of bounding in the hill training program, then skip bounding can also be incorporated. Skip bounding is perhaps more rhythmic than other bounding styles, and rhythmic movement

should be cultivated, especially by the sprinter. However, coaches should first attempt skip bounding, because they need to appreciate how exhausting it is before prescribing it to athletes. Skip bounding should be done for height as opposed to distance, thus to cover just 60 meters would completely exhaust the ATP-PC energy system. The skip bounding training session is then best suited to sprinters and middle distance runners, as opposed to long distance runners. An effective way to train the ATP-PC and ATP-Lactic Acid systems on a short hill is to skip bound 60 meters, then sprint the last 40 meters. Athletes will then be too exhausted to sprint at anything faster than 3/4-speed, and so they will not be sharpening. Physiologically, and certainly by way of subjective feeling, the sprint segment run on the ATP-Lactic Acid system is probably the closest thing to simulating the last 100 meters of the 400 meters event. The advantages are that this does not require a long hill, and the relatively slow speeds fully stress the anaerobic systems without substantially sharpening the athletes. Nevertheless, bear in mind the effect of this anaerobic work upon the balance of the training being conducted during the athletic season.

Sprint coaches sometimes advocate downhill running. The primary aim being to enhance speed. This activity is then most often performed during the sprinter's sharpening and peak periods. However, if downhill running is planned for the sharpening period, then some downhill running should also be done at controlled speeds during the hill period, because the potential for injury at a later date would otherwise be exceptionally high. In any case, the quantity of downhill sprint training should be low and the grade of the hill slight—less than three percent. Otherwise, the risk of injury to an athlete's lower back and hamstrings would be great.

The Long Sprint Events

Quantity will tend to compromise and suppress quality, and the converse is also true. The shorter the duration of the main race event (or the greater the athlete's deficiency of requisite strength), the more should hill training incorporate quality at the expense of quantity. Although training for the 400 meters is not the focus of this text, it will be briefly discussed vis-á-vis middle distance running, since 400 meters constitutes the under-distance event relative to the 800 meters.

The hill training progression for specialists at 400 meters should include a maximum of six to eight structured hill training sessions conducted during three to four workweeks within a hill period lasting between four to six weeks. In contrast with middle distance and distance runners, specialists at 400 meters will not normally include a hill circuit in their training program. Table 3.5 provides a hill training progression for athletes preparing for 400 meters. They should begin with more numerous short reps, and then progress to fewer reps and greater distances.

The grade of the hill and length of the recovery periods also affect the quality of the hill training, as do the technique and running speed of the athletes. Obviously, the shorter the main race event, the more explosive the hill repetitions should be. For athletes training for 400 meters, the recovery period can be a full downhill walk or jog and need not be otherwise controlled, so long as their resting

Distance (meters)	Number
100	10
150	8
200	6
300	5
400	4
500	3
600	2

TABLE 3.5

pulse does not fall below 120 bpm between repetitions (which could indicate a loss of sufficient warm-up). Pay close attention to the duration of the hill repetitions since the distance covered can be a deficient measure of the work actually being done.

Middle Distance Events

This discussion will focus on preparing athletes for 800 and 1,500 meters. Again, a maximum of four workweeks and two regenerative weeks can be assumed by mature athletes within a hill period of four to six weeks. Given that only two 3/4-effort training sessions are possible over a seven day period, a maximum of six to eight 3/4-effort training sessions are possible during the hill period. Obviously, any competitions or time trials undertaken must be counted against this total.

Middle distance runners could perform a 3/4-effort hill circuit on Tuesday, four days previous to a more highly structured 3/4-effort hill repetition workout on Saturday, or vice-versa. Accordingly, during a typical workweek, a training session including continuous running on a hill circuit alternates with another including shorter and faster hill repetitions. The hill circuit can be one continuous loop or can comprise a smaller closed loop. For example, a 3,000 meters loop could be run two to four times with five minutes of easy running recovery between each hill circuit. The objective would be to run all of the circuits in approximately the same time during any given 3/4-effort training session. In succeeding weeks, athletes will naturally post faster times over the hill circuit.

In the more structured hill workout, normally conducted on Saturday, the duration or distance of the hill repetitions would be gradually progressed. Table 3.6 provides a hill training progression suitable for mature specialists at 800 and 1,500 meters.

The specialist at 800 meters will normally assume fewer hill repetitions, but will conduct them at greater speed than the specialist at 1,500 meters. The same is true of the specialist at 1,500 versus 3,000 meters. When conducting the longer hill repetitions, a segment of controlled downhill running can be incorporated to enhance the quality of the recovery period. To better facilitate recovery, athletes can also run two easy accelerations between 100 and 200 meters in length at the top and bottom of the hill.

Distance (meters)	Number
100	20
200	16
300	12
400	10
600	8
800	6
1,200	4

TABLE 3.6

Generally, novice runners are not physically or mentally capable of handling a high quality recovery period. Most are not yet mature enough to endure high intensity levels, nor should they be expected to. If and when athletes are ready to make a 3/4-effort in training—well, then they are ready. Most people are never ready. This is not to say they should be. It simply is the natural order of things. Normally, the number of hill repetitions and the training volume for young athletes should be reduced by at least 25%. Novice high school athletes will be doing all they can, both physically and mentally, to simply run to the top of the hills. The next step in improving quality would be for them to run through the top of the hills and then at least 20 to 30 meters beyond. This causes a cardiovascular and respiratory adjustment that affects the heart, diaphragm, and breathing pattern in a way that is often experienced as distressful. Athletes should not clench their teeth and resist the pain, rather embrace it and instead maintain their concentration.

Long Distance Events

When preparing for long distance events, athletes are not so concerned with training the anaerobic energy systems and muscle fiber types for explosive power. Instead, the objective is to further enhance their aerobic ability with the use of supra-normal training loads, but without inducing a substantial sharpening effect. Again, an important aspect of fitness is developed when athletes train near their anaerobic threshold while simultaneously applying muscular strength to overcome the resistance of a supra-normal training load. All other things being equal, athletes who have cultivated greater strength and aerobic ability by incorporating hills or other resistance work in their running program will exhibit less blood lactate accumulation while performing a given sub-maximal work load. Moreover, the athletes will be able to exercise longer, while maintaining a higher equilibrium blood lactate level, and their anaerobic threshold will then comprise a higher percentage of their maximum oxygen uptake.

Running in the mountains at altitude provides at least two different stimuli for imposing supra-normal training loads. Further, the following athletes performed fartlek training while running fully clothed in ankle deep snow: Gunder Haegg, the former World Record holder in the mile, Emil Zatopek, the 1952 Olympic Champion at 5,000 meters, 10,000 meters and the marathon, and Lasse Viren,

the 1972 and 1976 Olympic Champion at both 5,000 and 10,000 meters. Running barefoot in sand dunes also imposes a similar supra-normal training load. The Australian coach Percy Cerutty, and Herb Elliott (the 1960 Olympic Champion at 1,500 meters) often trained barefoot in the sand dunes surrounding Portsea, Australia. Here in the United States, Bill Dellinger, Bronze Medallist in the 5,000 meters at the 1964 Olympic Games, once measured the distance of intervals by counting strides on his fingers as he ran barefoot along the beach. Pat Porter, the United States National Cross-Country Champion for nearly a decade, utilized both altitude and sand dunes when training in Alamosa, Colorado. Joan Benoit Samuelson, the 1984 Olympic Champion in the marathon, once lived in Florence, Oregon and sometimes trained in the Oregon Dunes National Recreation Area. When injured, she was capable of riding an exercise bicycle for over an hour with the resistance put at the highest setting (Sevene, 1985). In brief, athletes who desire to achieve supra-normal levels of athletic performance are well advised to assume supra-normal training loads. Accordingly, aspiring national or international class athletes should seek out and incorporate challenging physical environments into their training programs.

Given the weekly training schedule provided herein, long distance runners competing in events ranging from 3,000 meters to the marathon are advised to conduct a 3/4-effort hill circuit, or a continuous run over demanding terrain on Tuesday, four days prior to a more highly structured 3/4-effort hill repetition workout on Saturday, or vice-versa. Given the relatively flat terrain of the Midwest region of the United States, a hill circuit on a demanding short course can provide a second best solution in lieu of a continuous run over equally challenging terrain on a long course. The Kenyan's have a demanding 21-kilometer route that climbs from approximately 5,000 to 8,500 feet of elevation, and similar courses exist in Boulder, Colorado.

Once again, the 3/4-effort workout, including a hill circuit or continuous run over demanding terrain, can be alternated with a more highly structured 3/4-effort hill repetition workout within a typical workweek during the hill period. The distance of the hill repetitions should gradually increase over succeeding weeks. With middle distance runners, it is sometimes possible to progress the distance or duration of the repetitions to equal the main race event. Of course, not many long distance runners will have a five to 10 kilometer hill in their backyard. The caveat being that if athletes are training at altitude, then they may indeed have a five to 10 kilometer hill in their backyard, and could then perform both the hill circuit and repetitions workouts over suitable long courses.

However, when conducting long repetitions, there is clearly a point of diminishing returns. After all, what goes up must come down. Unless an athlete has some means of quickly getting back to the bottom of a hill, thus permitting a recovery period of reasonable duration, the goal of the training session can be compromised. Introducing a segment of gentle downhill running can strengthen the abdominals and can also serve as a partial solution to the problem of exorbitant recovery. However, while downhill running does condition the

abdominals and diaphragm, the shock associated with this activity can be injurious to the legs and lower back. Regardless of the efficiency of an athlete's downhill running technique, it is prudent to guard the quantity and quality being assumed.

One-half to three quarters of a mile normally represents the practical limit with respect to the hill repetitions conducted by long distance runners, but consider the following true story: On Highway 96 near the St. Croix river just outside of Stillwater, Minnesota, there is a demanding hill 1,200 meters long that levels off slightly over an additional 400 meters. To run a full uphill mile and then all the way back down five times would be ten miles. And who needs all that recovery? The coach (or chauffeur) on the scene piled a number of athletes into the back of a subcompact car and dropped them off at the bottom of the hill. The coach then drove to the top of the hill where he would wait for the athletes with a stopwatch. Of course, the athletes would then crawl into the back seat once again to be whisked off to the base of the hill in something less than a three-minute recovery period before the next repetition. Some might question the prudence of this practice, but most of the Midwest region in the United States is notoriously flat. And in the winter months, when road conditions in Minnesota prohibit quality hill work, dedicated athletes can sometimes still be found running up various parking ramps, or dashing up the stair wells of tall buildings, only to take the elevator back down to start the next repetition. Table 3.7 provides a progression of hill repetitions suitable for use by mature athletes.

Athletes can acquire some important physical and mental skills by running hill repetitions approximately a mile long. These skills relate to the manner in which they impart muscular force, and endure physical and mental fatigue. Running long hill repetitions provides a mental exercise in concentration. Athletes must focus on breathing and bodily relaxation while simultaneously delivering near-maximal effort. On hills shorter than a half mile in length, it is still possible for athletes to will themselves with their egos and force their way up with relatively inefficient running technique and energy expenditure. Athletes can then still mentally attach to the effort and pain, but overcome it by an act of will. However, superior performances are not attained by the ego and will. They are achieved by surrendering the ego, and concentrating on the moment. Running on long hills provides such a lesson in non-attachment. If athletes apply the same willful technique to running long hill repetitions, they will not be able to complete them well. When half way up the hill, athletes must learn to not attach to the pain they have experienced, rather they must let it go. In addition, they must learn to not attach to the pain waiting for them further up the hill, rather they must concentrate on their breathing and the immediate biofeedback of the moment. Athletes must be able to relax and minimize muscle tension while simultaneously putting forth a near maximal running effort, as this will permit them to best employ their aerobic ability. Many individuals have unconsciously learned to resist pain or fatigue by increasing muscular tension. With respect to distance running, this is dysfunctional. Tension induced by fear and a lack of focus results in the degradation of a runner's aerobic ability.

Distance (meters)	Number
200	16
300	12
400	10
600	8
800	6
1,200	5
1,600	4

TABLE 3.7

Structure and Athletic Maturity

Novice athletes lack the knowledge and experience required to successfully perform athletic training in a completely unstructured environment. In the absence of guidance, they will train unintelligently, and so injure or exhaust themselves. Because of this, young athletes initially require education, and need a teacher or coach. In fact, they will often demand structure to clarify the training task: What hill? How many times? How Fast? In time, as the athletes gain understanding and experience, and acquire a better feel for their abilities, they will eventually desire and should be granted relative freedom.

> ***Overtraining is the biggest problem incurred by runners who lack the experience or discipline to cope with their own enthusiasm.***
>
> —Marty Liquori

Ultimately, the aim of the coach should be to liberate young athletes from the structure that was once provided out of necessity. In fact, during the first few days of practice at the beginning of a season, it is appropriate for a coach to conduct several one-hour classes on the subject of athletic training. At the end of this exercise, each athlete should leave the classroom with a calendar including a schedule for the entire season written in their own hand. As the season progresses, the coach can then work with each athlete individually, and communicate at a mature level. The results will reflect it.

When a coach plays a dominating or controlling role, and athletes simply glance at the workout schedule each day, something is fundamentally wrong. That kind of coach/athlete relationship does not truly involve education, nor does it yield the best results. Unfortunately, it is common to see mutual dependency needs played out between athletes and their coaches. The athletes want their coaches to play the role of their father or the Almighty, and the coaches want the athletes to make them feel like it. This situation is not healthy for either party.

Accordingly, the training of mature athletes should not be regimented. Rather, the coach (who at this point has become something of an advisor) guides the athletes towards the training task. Relative freedom is granted with the certain knowledge that the quality of the training will be enhanced over and above the more highly structured methods that may have been necessary in their youth. The mature athlete will then plan a progression of workouts, some highly structured, and some not, adapting them to circumstances. In no event will the schedule serve as more than a guide. When in doubt, listen to your body and the whisper of intuition.

The gift of enlightenment is a partial product of cultivating wholeness. This entails being receptive to alternative ways of knowing, and striking a balance between head and heart—thinking and feeling, judging and perceiving, feeling and intuition. The knowledge gained thereby can contribute to the ability to make accurate plans and predictions. However, life is characterized by change, spontaneity, and uncertainty. Even with the best-laid plans, it is necessary for athletes to correctly interpret their status at any point in time, and prudently modify their training program.

> ***A constant vigilance and attention to the train of things as they successively emerge, and to act on what they direct, are the only sure courses… Circumstances give to each act its distinguishing color and discriminating effect.***
>
> —Edmund Burke

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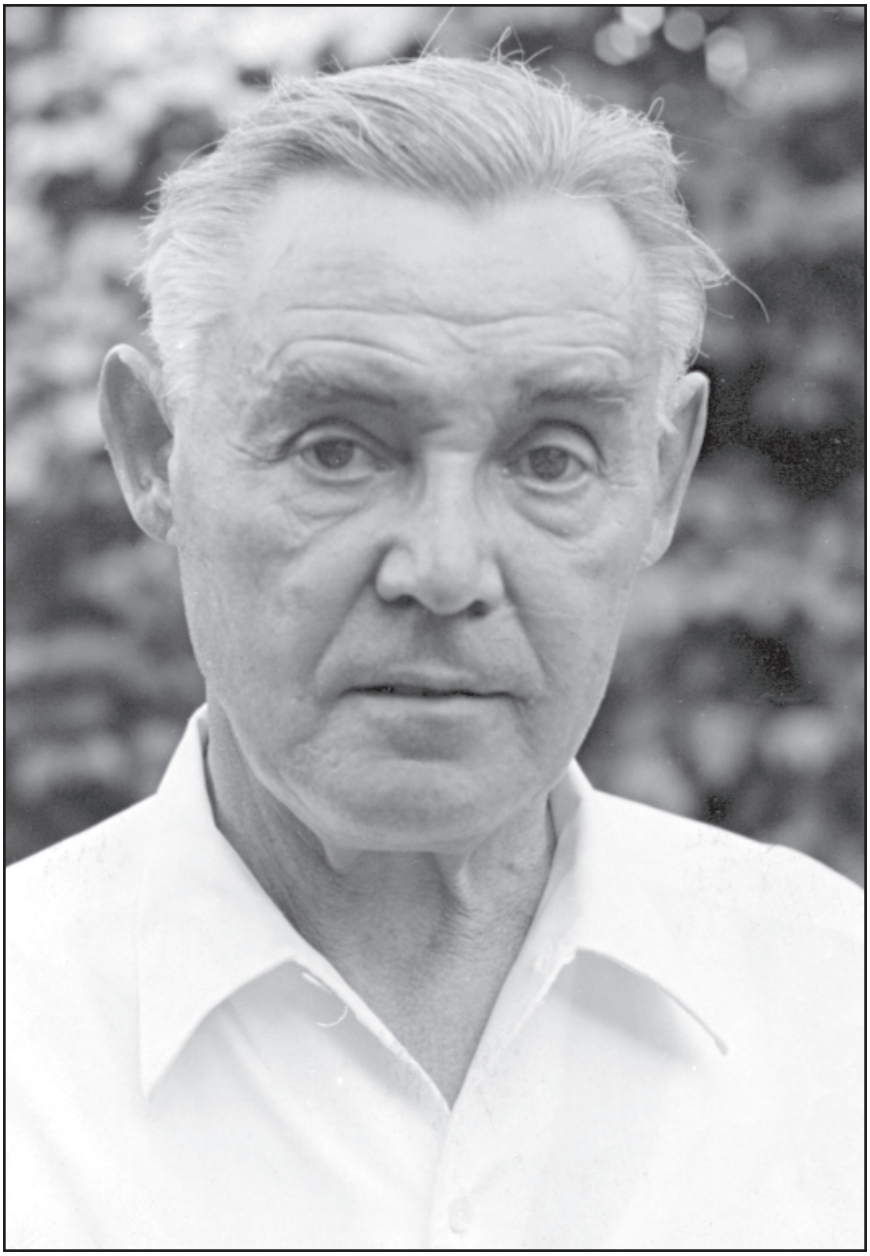


PHOTO 4.1—Woldemar Gerschler, who with the assistance of exercise physiologist Dr. Herbert Reindell, was the pioneer of modern interval training. Gerschler was an educator at the University of Freiburg, and influenced former 800 meters World Record holders Rudolf Harbig, and also Roger Moens. Photo courtesy of Dr. Klaus-Jürgen Müller, University of Freiburg, Germany.

CHAPTER 4

The Sharpening Period

The sharpening period is a time of specific conditioning for athletic performance in the selected main race event. The preceding base and hill periods are devoted to general conditioning, which primarily enhance an athlete's aerobic ability and muscular strength. However, it is during the sharpening period that the athlete's acquired powers are truly integrated and translated into the ability to sustain a desired goal pace over the duration of the main race event.

Duration of the Sharpening Period

Arthur Lydiard of New Zealand is credited with identifying the various athletic training periods and addressing many of their governing principles. Extensive physiological studies have confirmed what Lydiard learned through experimentation: The human body requires no more than approximately four weeks of sharpening work (Lydiard and Gilmour, 1962, and 1978). Nevertheless, many variables must be considered when planning the actual duration of the sharpening period for an individual athlete. As can be expected, the mature athlete who enjoys a higher aerobic ability, and more extensive training background will require and be able to sustain a longer sharpening period. Female athletes normally require about 30% less sharpening work than men. This reflects the difference in their relative aerobic ability. On the other hand, female athletes often benefit from roughly 30% more strength training and hill work than men, due to the relative difference in their natural endowment (Åstrand, 1986). That is why women should generally assume four workweeks of hill training and only three weeks of sharpening work, whereas the normal prescription for men is just the opposite.

The nature of the competitive season and racing distance being assumed must also be considered. As a rule, athletes do not need to sharpen as much for cross-country as they do for the track and field season, nor do they have to sharpen as much for the 10,000 meters as for the 800 or 1,500 meters. And the more muscular type who drives into the running surface often requires a bit more sharpening work than the lighter type whose technique seems to carry them over the ground. Again, consider the athlete's age and level of development, because young athletes will not require or be able to sustain as much sharpening work. For example, a high school athlete attempting to run five minutes for the mile does not require the same amount of sharpening as an athlete attempting to run a sub-four-minute mile. High school boys with a physical age corresponding to the freshman and sophomore years should not attempt more than three weeks of sharpening work. The same holds true for all high school girls, with the exception

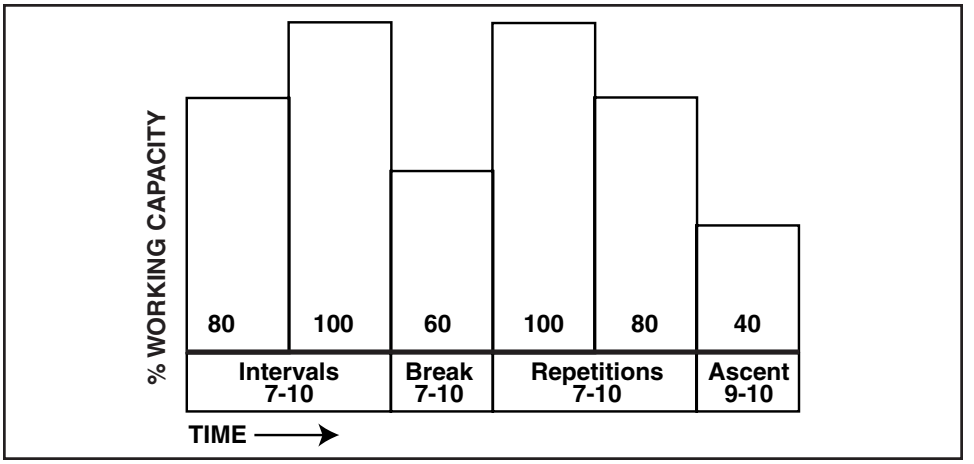


FIGURE 4.1—Mesocycle structure of the sharpening period

of mature juniors and seniors competing at 400 meters, 800 meters, or 800-meter sided competitors at 1,500 meters. Mature high school boys normally benefit from four weeks of sharpening work.

The prescription for collegiate men and women is essentially the same, but with the addition of approximately five days—that is, the possible addition of one or two sharpening efforts. Normally, a total of five quality sharpening sessions at 3/4-effort, and two competitions over a four to five week period is sufficient for athletes to attain peak competitive fitness. Even world-class athletes must be careful when attempting to go beyond four weeks (28 days) of sharpening work, because 33 to 35 days probably represents an absolute maximum before such work proves counterproductive.

The Sharpening Period Meso-Cycles

This is a brief review of the discussion found in Chapter 1. It would be unwise to attempt three to four weeks of the most demanding work of the athletic season without taking a worthwhile break. The sharpening period therefore includes a worthwhile break of seven to 10 days, which divides it into two meso-cycles.

As previously noted, it is advantageous to increase the training loads (as in the Matveyew model), during the first seven-to-10-day sharpening meso-cycle, when interval work predominates. Then follows an easy week or worthwhile break, conducted at no more than 60% of working capacity. This break normally includes an under-distance time trial or competition three to five days prior to performance in the main race event, and serves to consolidate the athlete's fitness. The second seven-to-10-day sharpening meso-cycle is then characterized by decreasing training loads (as in the Vorobyew model). Accordingly, the overall training load begins at 100% of working capacity, but then decreases to 80%, and finally, to less than 60% during the second worthwhile break. This second break may last between seven to 14 days, and normally, nine to 10 days is optimal for high school and collegiate athletes. This worthwhile break corre-

sponds to the so-called taper or ascent to the plateau of peak performance that follows directly.

The reduced effort of the training loads undertaken near the end of the second sharpening meso-cycle can facilitate respectable, even if not optimal competitive performances within the nine-to-10-day ascent to peak performance. During the worthwhile break and ascent, the residual fatigue induced by previous hard training will clear, and the athlete's energy will rebound.

Again, counting back approximately nine to 10 days from the first desired performance on the plateau of peak performance marks the beginning of the ascent. Then count back three to four weeks to establish the beginning of the sharpening period.

Micro-Cycle or Weekly Structure of the Sharpening Period

The basic micro-cycle structure of the sharpening period is consistent with that outlined in Chapter 1. Given the complexity of the sharpening period, numerous training schedule examples for cross-country and track and field have been provided later in this chapter, and in Appendix I. An abstract model and schedule suited for middle distance events during the sharpening period is provided below. However, the proximity of the 3/4-effort workout in the second meso-cycle, only three days after a competition in the main race event, renders this schedule unsuitable for athletes in the long distance events. Obviously, substantial variation can exist between different individuals and competitive schedules. Nevertheless, carefully study the training schedules provided. In particular, notice the pattern and alternation of sharpening work for the main race event, over-distance, under-distance, the wide separation of sharpening efforts, and the placement of the major competitions.

End of the Hill Period / Start of the Sharpening Period
First Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, Intervals for the Main Race Event
Wednesday	Active Recovery
Thursday	1/2-Effort, Fartlek + Finishing Speed
Friday	Active Recovery
Saturday	3/4-Effort, Intervals for the Over-Distance Event
Sunday	Easy Effort, Long Run

Worthwhile Break

Monday	Passive Recovery
Tuesday	3/4-Effort, Time Trial in the Under-Distance Event
Wednesday	Active Recovery + Finishing Speed
Thursday	Easy Recovery
Friday	Day Before Race Routine
Saturday	Race the Main Race Event
Sunday	Easy Effort, Long Run

Second Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, Repetitions for the Main Race Event
Wednesday	Active Recovery
Thursday	1/2-Effort, Fartlek + Finishing Speed
Friday	Active Recovery
Saturday	3/4-Effort, Repetitions for the Main Race Event
Sunday	Easy Effort, Long Run
Monday	Passive Recovery
Tuesday	1/2-Effort, Fartlek + Finishing Speed
Wednesday	Active Recovery
Thursday	3/4-Effort, Repetitions for the Over-Distance Event

End of the Sharpening Period / Beginning of the Ascent

The first time trial or competition, within the nine-to-10-day ascent to the plateau, would not be conducted sooner than four to five days after the last quality 3/4-effort repetition session shown above. This time trial or competition is then used to set up athletes for their first true peak performance in the main race event some three to five days later. Accordingly, with high school and collegiate athletes, the last high quality training effort of the sharpening period will normally fall nine to 10 days prior to the first peak performance. Elite athletes who regularly undertake 100+ miles per week, enjoy a greater load and recovery capability, and therefore, can sometimes assume a worthwhile break lasting only seven days.

The Main Race Event and Goal Performance

By the end of the base and hill periods, athletes must make a final decision and select the athlete's main race event. Ideally, this decision will be made prior to the athletic season. In addition, a realistic goal for optimal performance in the main race event should be set. If athletes try for too little, they will miss out on what they might have accomplished. On the other hand, if runners overestimate their ability and try for too much, they will get into trouble when attempting the quantity and quality called for in the sharpening workouts, and over-train.

Athletes should avoid unnecessarily testing themselves in the course of training: that reflects a lack of confidence, and ultimately compromises training, thus proves counterproductive. Athletes who unduly test themselves could reach a less than optimal so-called peak relatively early in the season, or suffer chronic fatigue and succumb to the so-called "burnt out" syndrome. Testing can also lead to mental gratification and satisfaction due to workout results—instead of race results. From the standpoint of mental preparation, athletes might then find themselves with insufficient emotional gumption to achieve peak performance when it counts.

The primary factor limiting how much quantity and quality can be assumed during the sharpening period is the aerobic ability and strength of the individual. If an athlete enters the sharpening period with the aerobic ability to run a 4:10 mile (as predicted by a clinical test of their VO_2 maximum, anaerobic threshold, and

running economy), then sharpening work can be conducted to realize that potential performance. However, no amount of sharpening work will enable that athlete to raise his aerobic ability sufficiently to run a 4:00 minute mile. No amount of wishful thinking will alter this fact of life. Many are misled by the fact that when athletes begin to conduct sharpening workouts, their performances begin to improve dramatically. Coaches and athletes might then assume that sharpening is the "right thing," and should be done all the time—the more the better. This is a grave error—a mistake that destroys more young athletes than any other. Sharpening an athlete for optimal performance can be like putting a point on a pencil. No amount of sharpening will transform a 2B lead, suitable for taking exams, into a 4B lead used in drawing. You can sharpen the pencil, but you cannot change the material of which the pencil is made, and would only consume it by making the attempt. When prescribing sharpening work to young athletes, always err on the side of leniency.

Once you have established a realistic goal performance in the main race event, you can determine the pace at which sharpening work should be conducted. It is simply done: The projected goal performance in the main race event determines the goal pace, and also substantially defines the training progression undertaken during the sharpening period. This agrees with the specificity of training principle, but physiologically speaking, why is this so?

Again, muscle fiber type has for many years been differentiated into fast-twitch Type II fibers (associated with explosive power) and slow-twitch Type I fibers (associated with endurance). More recently, so-called swing fibers have been recognized (that is, fast-twitch Type IIc fibers that can take on qualities of the slow-twitch). In truth, muscle fiber types are largely determined by their metabolic characteristics and enzyme profiles. Although the ratio of fast to slow twitch fibers appears to be genetically determined, the enzyme profiles among fast twitch Types II a/b/c fibers will adapt specifically in response to the nature of the training load (Åstrand, 1986). Muscle glycogen is also stored and summoned specifically by the local energy demands of previous exhaustive efforts. Neuro-muscular learning, coordination, and running economy also improve with specific training. For any given individual, an ideal mix of physiological attributes exists that is most conducive to optimal performance over a specific racing distance. In the words of the Australian coach Percy Cerutty: "Muscles are educated by movement" (Cerutty, 1967).

Date Pace and Finishing Speed Progressions

During the preceding base and hill periods, athletes will normally conduct date-pace work once a week in conjunction with a fartlek session. In the course of this work, athletes will have also instilled a dominant sense of pace, that is, a mental clock, or habit associated with a neuromuscular stereotype.

In the course of an athletic competition, conscious control gives way to an instinctive, intuitive and unconsciously conscious mode of functioning that might be described as a special form of automatism. In fact, if a letting-go of the

attachments of the ego during the competition does not occur, a superior performance will not be delivered!

So, sound training habits are extremely important. We are all familiar with the athlete who eases up in the last five to 10 meters of a race and is defeated because that same easing of effort has occurred many times in the training. It has become the dominant habit, and closely resembles a conditioned response. Pace sense is a similar phenomenon. If athletes do not have that internal clock, then they will waver in competition as though lost, unless another competitor assumes the lead and does all the work—thus they are incapable of delivering a superior performance alone, or from the lead. Therefore, athletes need to enter the sharpening period having already conducted the date pace work required to facilitate sharpening work and performance at goal pace in the main race event, because the requisite physical and mental adaptations normally take approximately three months to instill.

Bill Bowerman's training prescription for date pace work represented a progression in quality of one second / 400 meters during the course of each succeeding monthly training cycle. Thus, in the four weeks preceding the sharpening period, date pace work would be conducted at projected goal pace for the main race event plus one second / 400 meters. In the month previous to that, the work would be done at goal pace plus two seconds / 400 meters, and so on. By the time athletes begin the sharpening period, they would then be sufficiently conditioned to goal pace so as to begin the sharpening work with minimal risk of injury (Bowerman, 1974).

This is a prudent training practice. However, in the context of this presentation, it would be more precise to say that the date pace work is reduced in quality by one second / 400 meters from goal pace during the first meso-cycle preceding the start of the sharpening period. The quality of date pace work then further reduces by an additional one second / 400 meters in each preceding meso-cycle. Again, during the course of an athletic season, the succeeding meso-cycles will decrease in length—from approximately 28 to 21 days, then to 14 days, and finally to between seven to 10 days—as the quality and intensity of the training increases.

The training schedule for an athletic season should indicate the progression of the athlete's fitness level in the goal main race event. The coach and athlete would also benefit from having an indication of the athlete's equivalent level of performance with respect to over-distance and under-distance events at any point in time. In addition, the date pace progression for the athlete's main race event should also be provided. The quality of the time trials or races conducted at the end of each meso-cycle will then directly correspond to the quality of the date pace work conducted during that meso-cycle. In addition, a sound progression of finishing speed work is required during the athletic season, and in particular, for those competing in the middle distance events. It is advisable to gradually progress the quality of finishing speed work by meso-cycle, but beginning with the worthwhile break that comprises the nine to 10 day ascent to the plateau.

Figures 1.27, 1.28, 1.29, and Tables 1.2 and 1.3 from Chapter 1 have been reproduced here for the sake of convenience, and now appear as Figures 4.2, 4.4, 4.5, and Tables 4.1 and 4.3, respectively. Figures 4.6 and 4.7 and Tables 4.2 and 4.4 also provide additional training schedules corresponding to the performance level of talented high school boys and girls. In addition, for possible use as worksheets, Figure 4.3, and Table 4.5 provide blank versions of the date pace and finishing speed progressions.

Abstract Sharpening Work Progression

If the coach and athlete have projected a realistic goal performance in the main race event and have properly conducted date pace work during the base and hill periods, then the next issue is how to best progress the sharpening work over the limited three to four week duration of the sharpening period. Previous discussion of training load tolerances suggested a maximum of two quality sessions at 3/4-effort, and one quality session at 1/2-effort in the course of any given week. That simple observation would establish an absolute limit of eight 3/4-effort training sessions over a four-week sharpening period, and any time trials or competitions must be further subtracted from this total.

In the training schedule examples provided later in this chapter, the actual number of possible 3/4-effort training sessions often total seven. Conducting a time trial and a competition during the worthwhile break taken between the two sharpening meso-cycles, thus reduces to five the number of 3/4-effort training sessions for the sharpening period. This will normally suffice to accomplish all the sharpening work required.

The fact that approximately five 3/4-effort training sessions constitute the primary training progression within the sharpening period should provide a sobering realization: make every training session count, and conduct the training progression so as to permit the athletes to assume optimal levels of quantity and quality. In practice, this suggests that they begin their sharpening work with interval training:

- Interval training workouts generally include a relatively large number of selected distances run in a series at equal to, or slower than goal pace in the main race event. These workouts also utilize a continuous jog or running recovery period of less than 2:30 duration, which substantially retains the venous preload on the heart and workload on the diaphragm.
- Repetition workouts generally include two or more selected distances, run at equal to, or faster than goal pace in the main race event. These workouts include a continuous jog or running recovery period equal to or greater than 2:30 duration. Repetition workouts normally come late in the sharpening period. In this treatment, the progression of sharpening work makes the point of transition between the conduct of intervals and repetitions difficult to discern.

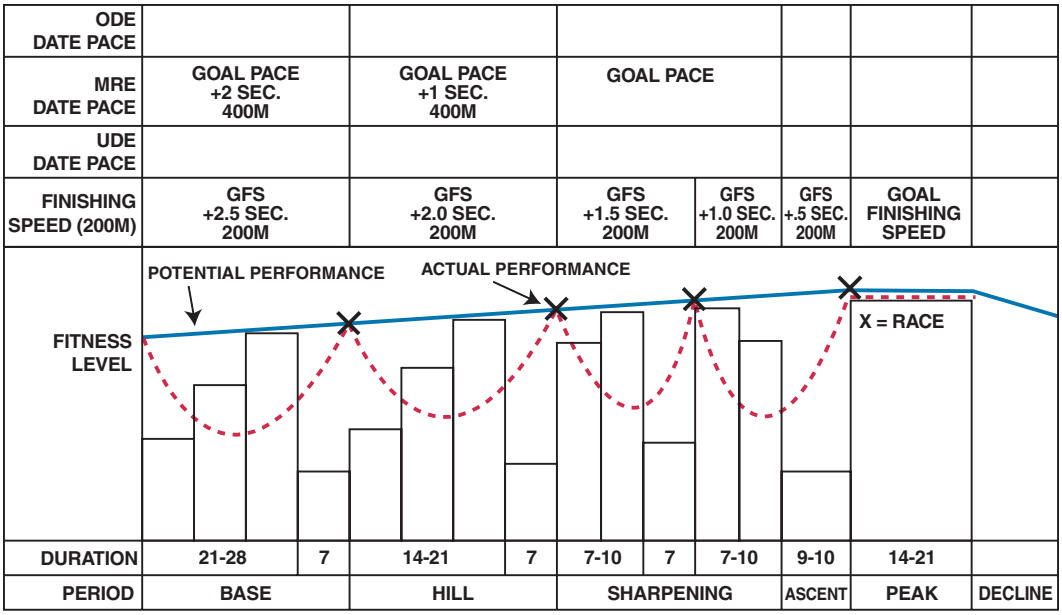


FIGURE 4.2—Date pace and finishing speed progressions

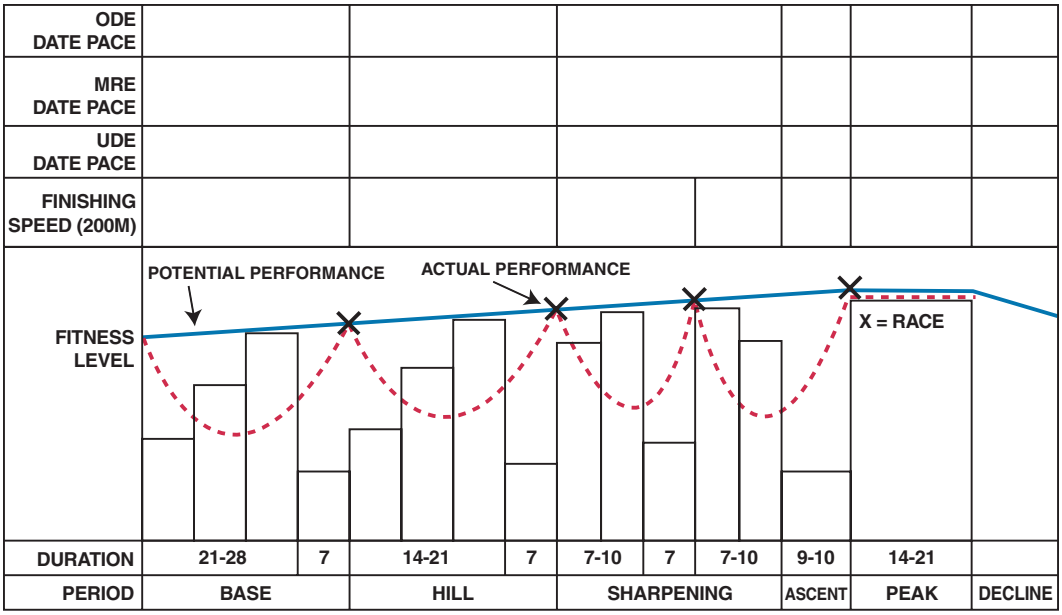


FIGURE 4.3—Date pace and finishing speed progression (blank)

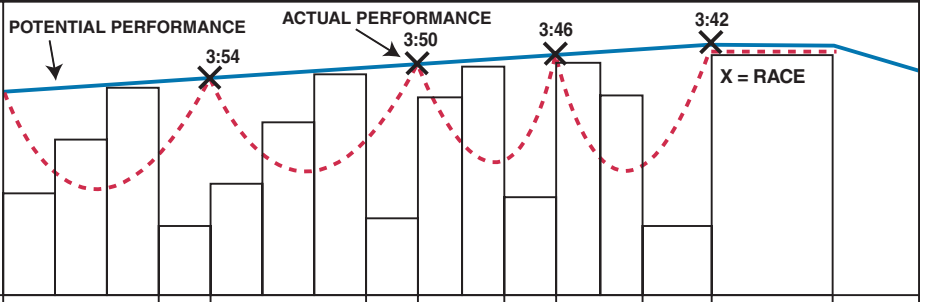
ODE: 5,000M DATE PACE FITNESS LEVEL	68 14:18	67 14:05	66 13:51			13:37	
MRE: 1,500M DATE PACE FITNESS LEVEL	62 3:54	61 3:50	60 3:46			3:42	
UDE: 800M DATE PACE FITNESS LEVEL	56 1:54	55 1:52	54 1:50			1:48	
FINISHING SPEED (200M)	25.0	24.5	24.0	23.5	23.0		
FITNESS LEVEL							
DURATION	21-28	7	14-21	7	7-10	7	7-10	9-10	14-21	
PERIOD	BASE		HILL		SHARPENING			ASCENT	PEAK	DECLINE

FIGURE 4.4—Schedule for a 1,500 meters performance of 3:42

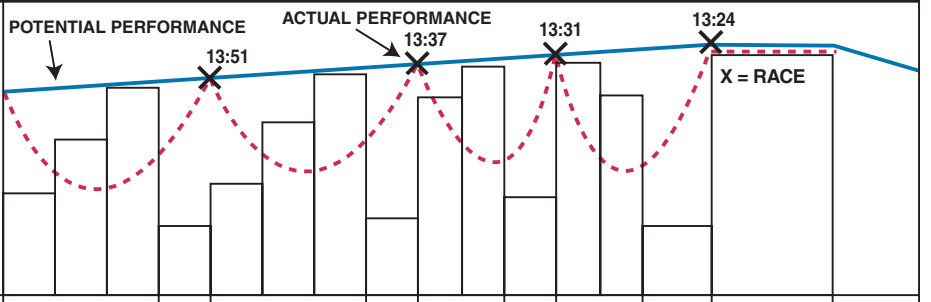
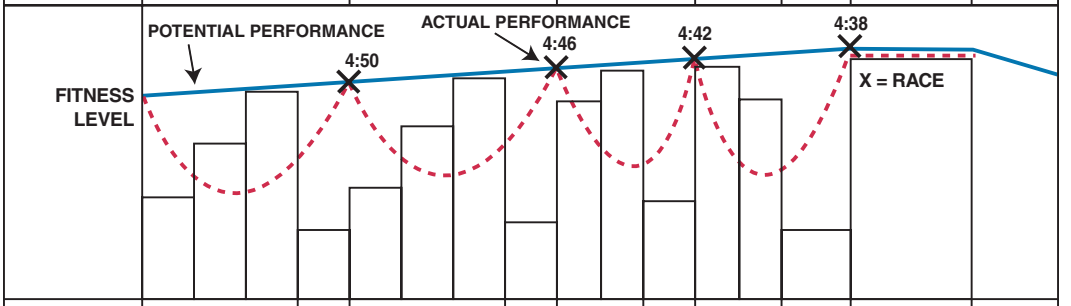
ODE: 10,000M DATE PACE FITNESS LEVEL	69-70 28:45	68-69 28:17	67-68 28:04			27:51	
MRE: 5,000M DATE PACE FITNESS LEVEL	66-67 13:51	65-66 13:37	64-65 13:31			13:24	
UDE: 1,500M DATE PACE FITNESS LEVEL	60-61 3:46	59-60 3:42	58-59 3:40			3:38	
FINISHING SPEED: 200M	26.0	25.5	25.0	24.5	24.0		
FITNESS LEVEL							
DURATION	21-28	7	14-21	7	7-10	7	7-10	9-10	14-21	
PERIOD	BASE		HILL		SHARPENING			ASCENT	PEAK	DECLINE

FIGURE 4.5—Schedule for a 5,000 meters performance of 13:24

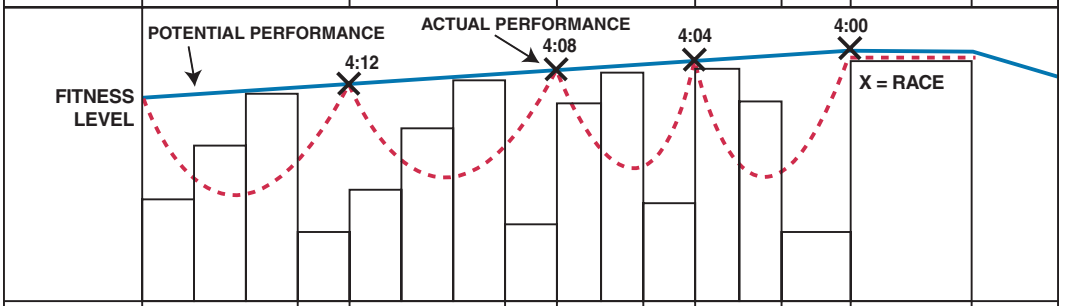
ODE: 3,000M DATE PACE FITNESS LEVEL	82 10:10	81 10:02	81 9:54			9:46	
MRE: 1,500M DATE PACE FITNESS LEVEL	77 4:50	76 4:46	75 4:42			4:38	
UDE: 800M DATE PACE FITNESS LEVEL	70 2:22	69 2:20	68 2:18			2:16	
FINISHING SPEED: 200M	28.0	27.5	27.0	26.5	26.0		



DURATION	21-28	7	14-21	7	7-10	7	7-10	9-10	14-21	
PERIOD	BASE		HILL		SHARPENING			ASCENT	PEAK	DECLINE

FIGURE 4.6—Schedule for a 1,500 meters performance of 4:38

ODE: 3,000M DATE PACE FITNESS LEVEL	71 8:54	70 8:46	69 8:38			8:30	
MRE: 1,500M DATE PACE FITNESS LEVEL	67 4:12	66 4:08	65 4:04			4:00	
UDE: 800M DATE PACE FITNESS LEVEL	61 2:03	60 2:01	58 1:59			1:57	
FINISHING SPEED: 200M	25.0	24.5	24.0	23.5	23.0		



DURATION	21-28	7	14-21	7	7-10	7	7-10	9-10	14-21	
PERIOD	BASE		HILL		SHARPENING			ASCENT	PEAK	DECLINE

FIGURE 4.7—Schedule for a 1,500 meters performance of 4:00

TRAINING PERIOD	800 METERS	1,500 METERS	3,000 METERS	5,000 METERS	10,000 METERS
BASE	26.0 5x150	27.0 5x200	28.0 5x200	29.0 5x200	30.0 5x200
HILL	25.5 5x100	26.5 5x150	27.5 5x200	28.5 5x200	29.5 5x200
SHARPENING PART 1	25.0 4x100	26.0 4x150	27.0 4x200	28.0 4x200	29.0 4x200
SHARPENING PART 2	24.5 4x60	25.5 4x100	26.5 4x150	27.5 4x200	28.5 4x200
ASCENT	24.0 3x60	25.0 3x100	26.0 3x150	27.0 3x200	28.0 3x200

TABLE 4.1—Finishing speed progression for world class women by event

TRAINING PERIOD	800 METERS	1,500 METERS	3,000 METERS	5,000 METERS
BASE	27.0 5x150	28.0 5x200	29.0 5x200	30.0 5x200
HILL	26.5 5x100	27.5 5x150	28.5 5x200	29.5 5x200
SHARPENING PART 1	26.0 4x100	27.0 4x150	28.0 4x200	29.0 4x200
SHARPENING PART 2	25.5 4x60	26.5 4x100	27.5 4x150	28.5 4x200
ASCENT	25.0 3x60	26.0 3x100	27.0 3x150	28.0 3x200

TABLE 4.2—Finishing speed progression for national class high school girls

TRAINING PERIOD	800 METERS	1,500 METERS	3,000 METERS	5,000 METERS	10,000 METERS
BASE	23.0 5x150	24.0 5x200	25.0 5x200	26.0 5x200	27.0 5x200
HILL	22.5 5x100	23.5 5x150	24.5 5x200	25.5 5x200	26.5 5x200
SHARPENING PART 1	22.0 4x100	23.0 4x150	24.0 4x200	25.0 4x200	26.0 4x200
SHARPENING PART 2	21.5 4x60	22.5 4x100	23.5 4x150	24.5 4x200	25.5 4x200
ASCENT	21.0 3x60	22.0 3x100	23.0 3x150	24.0 3x200	25.0 3x200

TABLE 4.3—Finishing speed progression for world class men by event

TRAINING PERIOD	800 METERS	1,500 METERS	3,000 METERS	5,000 METERS
BASE	24.0 5x150	25.0 5x200	26.0 5x200	27.0 5x200
HILL	23.5 5x100	24.5 5x150	25.5 5x200	26.5 5x200
SHARPENING PART 1	23.0 4x100	24.0 4x150	25.0 4x200	26.0 4x200
SHARPENING PART 2	22.5 4x60	23.5 4x100	24.5 4x150	25.5 4x200
ASCENT	22.0 3x60	23.0 3x100	24.0 3x150	25.0 3x200

TABLE 4.4—Finishing speed progression for national class high school boys

TRAINING PERIOD	800 METERS	1,500 METERS	3,000 METERS	5,000 METERS	10,000 METERS
BASE					
HILL					
SHARPENING PART 1					
SHARPENING PART 2					
ASCENT					

TABLE 4.5—Finishing speed progression (blank)

As can be gleaned from these figures and tables, the aim of the training progression undertaken during the sharpening period should be to provide just that—a true progression and continuity—so that athletes are, in the words of Lydiard, “training and not straining” their way to higher levels of fitness.

There are a number of reasons for beginning the sharpening period with interval training. It will be difficult enough for middle distance and distance runners to undertake intervals between 100 to 400 meters in the first session, since they are not yet fully accustomed to the quality associated with goal pace. Physiologically, interval training brings the heart and diaphragm to a higher level of fitness, thus enhancing the quality of the repetition training later on. In contrast with repetition training, which is more highly anaerobic, properly conducted interval training will normally not so greatly stress an athlete’s metabolism.

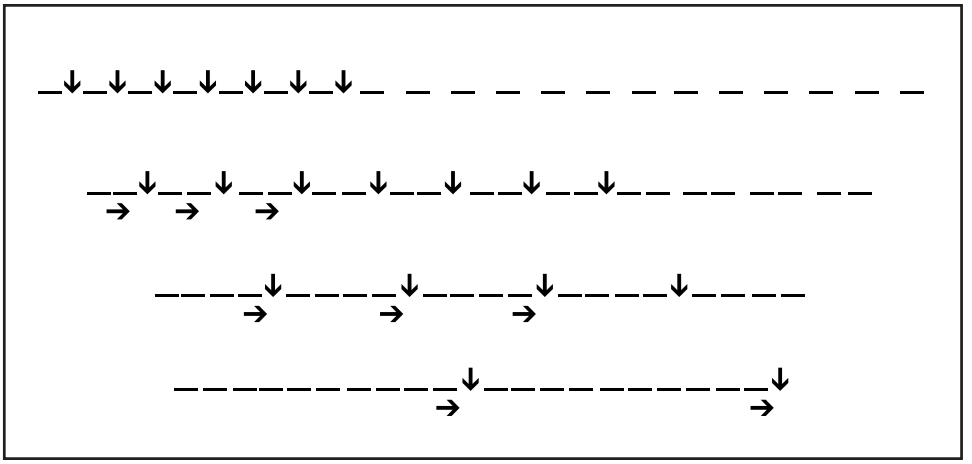


FIGURE 4.8

When performing interval training, athletes should run the desired pace—no faster or slower—and take up any slack in the effort of the workout by pushing or squeezing the recovery periods. Avoid unevenness in the pacing of the interval training, since one of its purposes is to instill a mental clock, or pace sense, needed for later repetition training and competition. Nevertheless, the exclusive conduct of interval training during the sharpening period would bring undesirable consequences.

Both Arthur Lydiard and Percy Cerutty criticized the intensive interval methods prevalent in their day by observing that the body and mind become conditioned to expecting an interval recovery that never comes in the race (See Lydiard, 1962, and Cerutty, 1961). Keep in mind this simple fact: the ultimate goal of the training progression is to physically and mentally condition the athletes to later execute a single repetition at projected goal pace in the main race event. This means that recovery periods must be either progressively absorbed by increased physical and mental conditioning, or likewise, deferred until after the training or racing effort.

For example, the training progression during the sharpening period could begin with an interval session with distances between 100 to 400 meters. An athlete would then be capable of handling a greater number of quality intervals at 800 meters sometime later. Then, after conducting the session at 800 meters, the athlete could better handle quality one-mile repetitions at a later date, as opposed to trying these repetitions immediately. Thus, a true progression permits the assumption of optimal levels of quantity and quality.

Therefore, in the training progression of the sharpening period, the distances being run tend to become fewer and longer, and incorporate like recovery periods. This sometimes makes it difficult to determine where the gradual transformation from interval to repetition training format actually takes place. The sharpening period training progression is constructed to condition the body and mind to make fewer and more maximal efforts, as the recovery periods are progressively absorbed by improved physical and mental conditioning, or deferred until after the training and racing effort. This principle is illustrated in Figure 4.8.

Again, in the early stages of the training progression athletes need to push or squeeze the recovery periods, since the ultimate aim is to eliminate them, that is, absorb and defer them until after the single repetition that constitutes the main race event. The quality of the recovery period is the most critical part of the interval sessions. However, as the sharpening period progresses, the recovery period becomes less and less important, and rather, the quality of the repetitions become the preeminent concern. To insure the desired quality of the repetitions, the recovery periods should then be extended as necessary. So, whereas an athlete might risk the quality of the series being run for the recovery period when doing intervals—just the opposite is true when conducting repetitions. Ultimately, when an athlete later runs a single repetition in the form of the main race event the recovery period is irrelevant. It does not matter whether the athlete lies spread-eagle on the grass afterwards. Of course, the caveat being that it *does* matter if the athlete needs to weather multiple qualifying heats. Accordingly, a runner needs to be specifically conditioned to meet the competitive demands.

The Need for Variation

The above discussion addresses an important characteristic, but threatens to oversimplify the training progression undertaken during the sharpening period. In the sharpening period, the meso-cycle structure defines the pattern of training loads and worthwhile breaks. This larger framework defines the number, placement, and characteristics of the quality training workouts. However, conducting sharpening work is not the only task to be accomplished at this time. To deliver optimal performances, it will be necessary to devote some time to maintaining previously acquired powers. The aerobic ability developed during the base period must be maintained by at least one long training run, conducted at less than 1/4-effort, over any given seven-to-10-day period. To facilitate recovery from sharpening work and maintain acquired strength, an athlete should occasionally conduct a 1/2-effort fartlek workout on hills, and also run over rolling terrain on the recovery days. The fitness of the heart and diaphragm can be maintained by running a series of 100-meter cross-field accelerations, incorporating a brief 50-meter jog-recovery during the warm-up and warm-down.

The key point: Do not let the structural emphasis of the training lead you to believe that various components of fitness, once acquired, are forever locked away for safekeeping. In this regard, without the conduct of suitable maintenance work, an athlete would begin to lose substantial aerobic ability after three weeks. The loss of significant levels of acquired strength would only take two weeks. And the loss of substantial fitness acquired via sharpening work would only take a week. This is relatively how fast an athlete would lose these components of fitness. However, considerably less time and energy is needed to maintain any given component of athletic fitness. But without maintenance work, the accumulated powers drain away, and subsequent training will then be building on quicksand.

Further, the sharpening work will not normally progress as indicated in Table 4.10, that is, with all of the quality sharpening workouts being run at goal pace for the main race event. Athletes preparing for the 800 meters can often conduct their

sharpening work this way, but it does not provide for optimal results in the long distance events. This degree of specificity is generally counterproductive for three reasons:

- Athletes must be capable of executing surges, a breakaway, and a finishing kick if they expect to compete at the highest level. This makes some under-distance and finishing speed work necessary.
- Runners must also maintain their stamina and endurance to handle preliminary qualifying rounds in championship competitions. And that would suggest conducting some anaerobic threshold and over-distance work, even during the sharpening period.
- Undertaking a gauntlet of sharpening work at goal pace for the main race event can produce adverse side-effects in the form of habituation, stagnation, and delayed recovery from exercise.

In addition, a fundamental training principle here defined as the principle of equilibrium needs to be examined.

The Principle of Equilibrium

The word equilibrium is used to describe the harmony amongst various components of fitness required for optimal performance. Disequilibrium then refers to administering these various components in a manner that is disproportionate or possibly even destructive to an athlete's requirements for optimal performance in a specific competitive event (See the discussion in Chapter 8 on strength training). The primary components of equilibrium are commonly assumed under the somewhat generic labels:

- Endurance
- Strength
- Speed

The most important thing to realize: the better one can read the needs and requirements governing the maintenance of equilibrium, the higher the quantity and quality an athlete can productively assume in training. When the training induces a state of disequilibrium, an athlete will experience higher levels of physical and mental fatigue. Remarkably, we could take the same athlete and with a properly composed training prescription, perhaps considerably increase the overall training load, yet find the individual both physically and mentally fit. The various physical and mental stimuli (and would-be stressors) tend to cancel out one another when equilibrium is maintained. Successful mature athletes develop a sixth sense in this regard, which is partly why they can sustain such heavy training loads. It is difficult to describe to one who has not had the experience.

In order to attain optimal competitive results, the coach and athlete must develop an intuitive sense for the athlete's needs when implementing the training program. Moreover, maintaining equilibrium is critical when attempting to extend

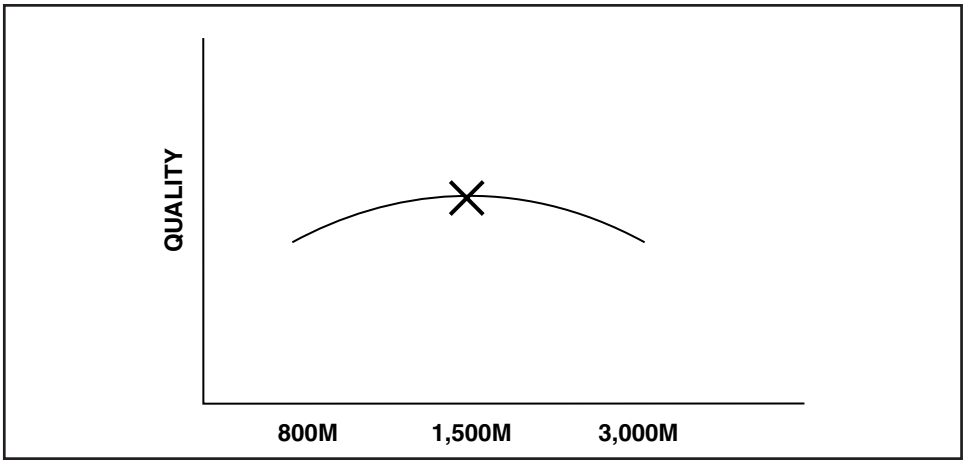


FIGURE 4.9

the plateau of peak performance by undertaking an extended or multiple-peak period. This is not to advocate the principle of equilibrium with the simple premise that more work is better. Given common practice of the day, often less work is in order. The essential point being: “Work does things, but intelligent work does things better” (Cerutty, 1961).

Equilibrium and the Concept of Balance

Whereas the word equilibrium describes the harmony between sometimes opposing aspects of fitness that contribute to optimal performance in the main race event, balance refers more specifically to an athlete’s over-distance versus under-distance ability. Equilibrium must be maintained, thus enabling a proper balance to be achieved. Clearly, the athlete should be balanced with respect to the main event. Inferior speed in the under-distance event ultimately acts as a governor on performance in the main race event. Inferior over-distance ability would suggest insufficient stamina to weather preliminary rounds of competition. The word balance has been employed, because if one were to graph the relative quality of an athlete’s performances at various distances, it would resemble a balance, with the main race event placed at the fulcrum as shown in Figure 4.9.

Event	Under	Main Event	Over
400	40%	30%	30%
800	50%	40%	10%
1,500	30%	40%	30%
5,000	40%	30%	20%
10,000	60%	30%	10%

TABLE 4.6

Balancing the Training Prescription

The question of equilibrium and balance presents itself throughout the athletic season, but it becomes particularly important during the sharpening and peak periods. Table 4.6 shows an abstract prescription regarding the balance of over-distance and under-distance work conducted during the sharpening and peak periods for various race events.

Take these estimations with a large grain of salt, since the actual training prescription for individual athletes will vary considerably. Nevertheless, this table provides abstract percentages relating to the sharpening work and racing conducted in various events. Young athletes, or those in early development, should fully develop their speed ability, thus assume more under-distance work when preparing for any given main race event. They should not rapidly move up to the 5,000 and 10,000 meters, as the rate of this transition could determine the ultimate length of their athletic careers. Also, the prescription for female athletes should be shifted slightly towards over-distance work because of the longer relative duration associated with competition in any given race event. However, the relative strengths and weaknesses of each individual athlete provide the main criteria for determining questions of equilibrium and balance. As shown in Table 4.7, it is possible to plan the balance of training during the sharpening and peak periods by recording the sessions under the following descriptive categories:

- Under-Distance Event (UDE)
- Over-Distance Event (ODE)
- Main Race Event (MRE)

Moreover, when making a plan or assessment, it is also possible to weigh the effort of the training sessions. The final percentages provided in Table 4.7 represent an abstract training prescription for a 400-meter sided competitor at 800 meters. However, apply only the training principles and general methodology, rather than use any example as an ideal prescription. As illustrated in the sharpening period model provided earlier, the preferred method for conducting sharpening work is to alternate between sessions that are directed under-distance, over-distance, and towards the main race event. *The decision analysis governing the composition of the training sessions and the athletic competitions should aim to maintain equilibrium and achieve optimal balance with respect to the main race event*. If an athlete is weaker on the speed (or under-distance) side of the main race event, they should conduct a larger proportion of under-distance work. If an athlete is weaker on the stamina (or over-distance) side, they should conduct a greater proportion of over-distance work to bring this aspect of fitness up to par, thus enhance later performance in the main race event. The coach and athlete then select how much under or over, and the specifics with regard to quantity (volume, duration) and quality (intensity, density and frequency), depending on the magnitude of the deficiency. For example, Table 4.7 shows calculations and ratios with respect to the various types of high-quality training sessions and competitions that could be assumed by an 800 meters specialist during the sharpening and peak periods.

800 Meters			
Sharpening Period Training	**UDE**	**MRE**	**ODE**
3(4 x 300) meters	0	1	0
2(4 x 400) meters	0	0	1
4 x 400 meters	0	1	0
2 x 600 meters	0	1	0
2 x 1,000 meters	0	0	1
4 x Finishing Speed	4	0	0
Sharpening Period Time Trials or Racing			
	2	1	0
Peak Period Training			
2 x Finishing Speed	2	0	0
Peak Period Time Trials or Racing			
	2	4	0
Totals	**10**	**8**	**2**
Percent	**50 %**	**40 %**	**10 %**

TABLE 4.7

Balance and Equivalent Performances

If an athlete will normally alternate between sessions geared for the over-distance, under-distance, and main race events, what is the appropriate quality of the over-distance and under-distance work? This question introduces the concept of equivalent performance(s) in the over-distance and under-distance events: It is best to direct over and under-distance work at the corresponding performance levels indicated by the projected goal performance in the main race event.

Table 4.8 provides formulas for calculating equivalent performances that can be easily memorized. They will enable a coach or athlete to quickly convert a given competitive result or performance prediction into its corresponding over-distance and under-distance equivalent (Fišer, 1965, Noakes,* 1991). These formulas presuppose comparable quality of preparation for the events, and are directed towards mature athletes. In most cases, the under-distance performance is a reliable indicator of performance in the immediate over-distance event. Obviously, the further away you project from a given performance, the less reliable the estimate can be. Nevertheless, the remarkable accuracy of these formulas to predict equivalent performances can be tested against the present world records, and an athlete's personal best performances (For prediction of athletic performance based on maximum oxygen uptake, see Daniels and Gilbert, 1979, and Daniels, 1998). Table 4.9 indicates equivalent athletic performances in the 800-10,000-meter events predicted from the formulas provided in Table 4.8 (Fišer, 1965).

Calculating Equivalent Performances 800 Meters - Marathon

Event(s)	Formula(s)
800 to 1,500m	2 (800m P.R.) + 6-8 seconds
1,500 to 3,000m	2 (1,500m P.R.) + 28 seconds
1,500 to 5,000m	5 (1,000m split from the 1,500m P.R.) +15-16 seconds
3,000 to 5,000m	5 (1,000m split from the 3,000m P.R.) + 3 seconds
5,000 to 10,000m	2 (5,000m P.R.) + 63-68 seconds
10,000 to 20,000m	2 (10,000m P.R.) + 2 minutes
10,000 to Marathon	5.48 (10,000m P.R.) + 28 minutes*

TABLE 4.8

Given a demonstrated performance, a coach or athlete can use the information provided in Tables 4.8 and 4.9 in order to determine the equivalent level of performance to attempt when competing in other events. This information is also needed to determine the appropriate level of quality to assume within the over-distance and under-distance training sessions relative to the goal performance in the main race event. In this regard, the predicted over-distance and under-distance performance establishes the pace (quality) at which the corresponding sharpening work should be conducted.

The Sharpening Work: Quantity

The preceding discussion has addressed the question of quality. It is now possible to consider appropriate levels of quantity that might be assumed during the sharpening period. Table 4.10 provides a progression of training sessions for various main race events, and also the equivalent progression of over-distance and under-distance training sessions. The indicated number of reps would be suitable for mature athletes. Generally, the training prescription for female or young athletes should be reduced by 30% across the board. Note that the main race event and the respective over-distance and under-distance sessions constitute equivalent training efforts at any given point in time within the progression. These can then be interchanged, depending on the individual athlete's requirements for maintaining equilibrium and proper balance. If an athlete appears to need more under-distance work at some point during the sharpening period, that would suggest the conduct of the equivalent under-distance workout corresponding to the training session indicated for the main race event, at that point in the training progression. The same kind of determination would also be made at any point if the question concerned the proper selection of an over-distance versus under-distance competition. Thus, one should follow the area of relative weakness and assume training or racing efforts that will best serve to maintain equilibrium and optimal balance.

The relative quantity athletes can assume in the equivalent under-distance training session is normally greater than their load tolerance in the over-distance sessions. For example, the specialist at 1,500 meters will normally be able to

Table Of Equivalent Performances

800m	1,500m	1,600m	3,000m	3,200m	5,000m	10,000m
1:40	3:26	3:44	7:22	7:55	12:45	26:33
1:41	3:28	3:46	7:26	7:59	12:52	26:46
1:42	3:30	3:48	7:30	8:03	12:58	26:59
1:43	3:32	3:50	7:34	8:07	13:07	27:12
1:44	3:34	3:52	7:38	8:11	13:11	27:25
1:45	3:36	3:54	7:42	8:15	13:18	27:38
1:46	3:38	3:56	7:46	8:19	13:24	27:51
1:47	3:40	3:58	7:50	8:23	13:31	28:04
1:48	3:42	4:00	7:54	8:27	13:37	28:17
1:49	3:44	4:02	7:58	8:32	13:44	28:31
1:50	3:46	4:04	8:02	8:36	13:51	28:45
1:51	3:48	4:06	8:06	8:40	13:57	28:59
1:52	3:50	4:08	8:10	8:44	14:05	29:13
1:53	3:52	4:10	8:14	8:44	14:12	29:26
1:54	3:54	4:12	8:18	8:52	14:18	29:39
1:55	3:56	4:14	8:22	8:56	14:25	29:52
1:56	3:58	4:16	8:26	9:00	14:31	30:05
1:57	4:00	4:18	8:30	9:04	14:38	30:19
1:58	4:02	4:20	8:34	9:08	14:45	30:33
1:59	4:04	4:22	8:38	9:13	14:52	30:49
2:00	4:06	4:24	8:42	9:17	14:58	30:59
2:01	4:08	4:26	8:46	9:21	15:05	31:12
2:02	4:10	4:28	8:50	9:25	15:11	31:25
2:03	4:12	4:30	8:54	9:29	15:17	31:38
2:04	4:14	4:32	8:58	9:33	15:24	31:51
2:05	4:16	4:34	9:02	9:37	15:30	32:04
2:06	4:18	4:36	9:06	9:41	15:37	32:17
2:07	4:20	4:38	9:10	9:44	15:45	32:32
2:08	4:22	4:40	9:14	9:49	15:52	32:47
2:09	4:24	4:43	9:18	9:54	15:59	33:00
2:10	4:26	4:45	9:22	9:59	16:05	33:13
2:12	4:30	4:49	9:30	10:07	16:18	33:39
2:14	4:34	4:53	9:38	10:15	16:31	34:05
2:16	4:38	4:57	9:46	10:23	16:45	34:33
2:18	4:42	5:01	9:54	10:31	16:58	34:59
2:20	4:46	5:06	10:02	10:40	17:11	35:25
2:22	4:50	5:10	10:10	10:48	17:24	35:51
2:24	4:54	5:12	10:18	10:56	17:38	36:19
2:26	4:58	5:16	10:26	11:04	17:51	36:45
2:28	5:02	5:20	10:34	11:12	18:05	37:13
2:30	5:06	5:26	10:42	11:20	18:18	37:39

TABLE 4.9

Equivalent Sharpening Training Progressions

200 Meters Under-Distance	**400 Meters Main Race Event**	**800 Meters Over-Distance**
Starts x 10	8-10 x 100m	3-4 (4 x 200m)
8-10 x 60m	6-8 x 150m	2-3 (4 x 300m)
4-6 x 100m	4-6 x 200m	4-5 x 400m
3 x 150m	3 x 300m	3 x 500m
2 x 300m ODE	2 x 500m ODE	2 x 600m
400 Meters Under-Distance	**800 Meters Main Race Event**	**1,500 Meters Over-Distance**
8-10 x 100m	3-4 (4 x 200m)	3-5 (4 x 200m)
6-8 x 150m	2-3 (4 x 300m)	2-3 (5 x 300m)
4-6 x 200m	4-5 x 400m	8-10 x 400m
3 x 300m	3 x 500m	4-6 x 600m
2 x 500m ODE	2 x 600m	2 x 800m
800 Meters Under-Distance	**1,500 Meters Main Race Event**	**5,000 Meters Over-Distance**
3-4 (4 x 200m)	3-5 (4 x 200m)	4 (5 x 200m)
2-3 (4 x 300m)	2-3 (5 x 300m)	3-4 (5 x 400m)
4-5 x 400m	8-10 x 400m	6-8 x 800m
3 x 500m	4-6 x 600m	5-6 x 1,000m
2 x 600m	2 x 800m	3-4 x 1,600m
1,500 Meters Under-Distance	**5,000 Meters Main Race Event**	**10,000 Meters Over-Distance**
3-5 (4 x 200m)	4 (5 x 200m)	4 (5 x 400m)
2-3 (5 x 300m)	3-4 (5 x 400m)	8-10 x 800m
8-10 x 400m	6-8 x 800m	6-8 x 1,000m/CR
4-6 x 600m	5-6 x 1,000m	5-6 x 1,600m/CR
2-3 x 800m	3-4 x 1,600m	2-3 x 3000m

TABLE 4.10

Typical Duration of Recovery Periods

200 Meters	Recovery Period
Starts x 10	walk full recovery
8-10 x 60m	walk full recovery
4-6 x 100m	walk/jog full recovery
3 x 150m	walk/jog full recovery
ODE 2 x 300m	walk/jog full recovery

400 Meters	Recovery Period
8-10 x 100m	1-3 minutes walk/jog recovery
6-8 x 150m	3-5 minutes walk/jog recovery
4-6 x 200m	5-7 minutes walk/jog recovery
3 x 300m	7-10 minutes walk/jog recovery
ODE 2 x 500m	10-15 minutes walk/jog recovery

800 Meters	Recovery Period
3-4(4 x 200m)	100m jog recovery; 400m jog recovery at series break
2-3(4 x 300m)	100m jog recovery; 400m jog recovery at series break
4-5 x 400m	400-800m jog recovery (5-7 minutes)
3 x 500m	600-800m jog recovery (7-10 minutes)
2 x 600m	800-1200m jog recovery (10-15 minutes)

1,500 Meters	Recovery Period
3-5(4 x 200m)	100m jog recovery; 400m jog recovery at series break
2-3(5 x 300m)	150m jog recovery; 400m jog recovery at series break
2(4-5 x 400m)	200m jog recovery; 400m jog recovery at series break
4-6 x 600m	300-400m jog recovery (3-5 minutes)
2 x 800m	800-1200m jog recovery (10-15 minutes)

5,000 Meters	Recovery Period
4(5 x 200m)	100m jog recovery; 200m jog recovery at series break
3-4(5 x 400m)	100m jog recovery; 400m jog recovery at series break
6-8 x 800m	200m jog recovery; 400m jog recovery at series break
5-6 x 1,000m	200-400m jog recovery (2-5 minutes)
3-4 x 1,600m	400-800m jog recovery (5-10 minutes)

10,000 Meters	Recovery Period
4(5 x 400m)	100m jog recovery; 200m jog recovery at series break
8-10 x 800m	200m jog recovery; 400m jog recovery at series break
6-8 x 1,000m	200-400m jog recovery (2-5 minutes)
5-6 x 1,600m	400m jog recovery (3-5 minutes Controlled Recovery)
2-3 x 3000m	800m jog recovery (5-10 minutes Controlled Recovery)

TABLE 4.11

PHOTO 4.2—Bill Dellinger setting the American 3-mile record, Madison Square Garden, 1959. Copyright Otto Bettmann/CORBIS. Reprinted with permission.

assume the maximum quantity indicated in the equivalent 800 meters training progression, but will likely only be able to undertake the minimum quantity indicated in the equivalent 5,000 meters progression. ODE stands for Over-Distance Event, and here indicates the quality at which the particular training session is conducted. The designation CR refers to Controlled Recovery, that is, an optional high quality running recovery period. This can be advantageous when athletes are training for 5,000 and 10,000 meters, since it extends the quality of the training effort over a longer duration. The CR does this by maintaining a high internal load during the would-be recovery period. This is necessary because, it is not possible to cover much quantity at quality in the long distance events, whereas this is clearly possible in the middle distance events. In contrast, the athlete competing at 10,000 meters cannot prudently attempt much more quantity in the training sessions at goal pace than the racing distance (See Dellinger and Beres, 1978). Table 4.11 indicates the recovery period typically associated with various training sessions.

TRAINING SCHEDULES BY EVENT

The following training schedules for events between 400 and 10,000 meters are provided for the sharpening period.

HIGH SCHOOL 400 METERS

Beginning of the Sharpening Period

First Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, 4-5 x 200m at 400m Goal Pace
Wednesday	Active Recovery
Thursday	1/2-Effort, 4 x 60m Starts
Friday	Active Recovery
Saturday	3/4-Effort, 3 (3 x 300m) at 800m Goal Pace
Sunday	Easy Effort, Long Run, 30-40 minutes

Worthwhile Break

Monday	Passive Recovery
Tuesday	Race 100m and 200m
Wednesday	Active Recovery
Thursday	Easy Recovery + 3 x 60m Starts
Friday	Day Before Race Routine
Saturday	Race 400m, 200m
Sunday	Easy Effort, Long Run, 30-40 minutes

Second Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, 3 x 500m at 800m Goal Pace
Wednesday	Active Recovery
Thursday	1/2-Effort, 3 x 60m Starts
Friday	Active Recovery
Saturday	3/4-Effort, 3 x 300m at 400m Goal Pace
Sunday	Easy Effort, Long Run, 30-40 minutes
Monday	Passive Recovery
Tuesday	1/2-Effort, 3 x 60m Starts
Wednesday	Active Recovery
Thursday	3/4-Effort, 2 x 600m at 800m Goal Pace

End of the Sharpening Period / Beginning of the Ascent

HIGH SCHOOL 800 METERS

Beginning of the Sharpening Period

First Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, 3(4 x 300m) at 800m Goal Pace
Wednesday	Active Recovery
Thursday	1/2-Effort, Fartlek + 4 x 100m at Finishing Speed
Friday	Active Recovery
Saturday	3/4-Effort, 2(4 x 400m) at 1,500m Goal Pace
Sunday	Easy Effort, Long Run, 40-60 minutes

Worthwhile Break

Monday	Passive Recovery
Tuesday	Race 400m and 200m
Wednesday	Active Recovery + 4 x 100m at Finishing Speed
Thursday	Easy Recovery
Friday	Day Before Race Routine
Saturday	Race 800m, 400m
Sunday	Easy Effort, Long Run, 40-60 minutes

Second Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, 4 x 400m at 800m Goal Pace
Wednesday	Active Recovery
Thursday	1/2-Effort, Fartlek + 4 x 100m at Finishing Speed
Friday	Active Recovery
Saturday	3/4-Effort, 3 x 500m at 800m Goal Pace, or Race 2 x 400m
Sunday	Easy Effort, Long Run, 40-60 minutes
Monday	Passive Recovery
Tuesday	1/2-Effort, Fartlek + 4 x 60m Starts
Wednesday	Active Recovery
Thursday	Time Trial(s) 600m, full recovery, then 300m

End of the Sharpening Period / Beginning of the Ascent

HIGH SCHOOL 1,500 METERS

Beginning of the Sharpening Period

First Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, 3(4 x 300m) at 1,500m Goal Pace
Wednesday	Active Recovery
Thursday	1/2-Effort, Fartlek + 4 x 150m at Finishing Speed
Friday	Active Recovery
Saturday	3/4-Effort, 6 x 800m at 3,000m Goal Pace
Sunday	Easy Effort, Long Run, 60-80 minutes

Worthwhile Break

Monday	Passive Recovery
Tuesday	Race 800m and 400m or Time Trial 1,000m, full recovery, then 300m
Wednesday	Active Recovery + 4 x 150m at Finishing Speed
Thursday	Easy Recovery
Friday	Day Before Race Routine
Saturday	Race 1,500m
Sunday	Easy Effort, Long Run, 60-80 minutes

Second Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, 2(4 x 400m) at 1,500m Goal Pace
Wednesday	Active Recovery
Thursday	1/2-Effort, Fartlek + 4 x 100m at Finishing Speed
Friday	Active Recovery
Saturday	Time Trial or Race 2 x 800m, or 800m and 400m
Sunday	Easy Effort, Long Run, 60-80 minutes
Monday	Passive Recovery
Tuesday	1/2-Effort, Fartlek + 4 x 100m at Finishing Speed
Wednesday	Active Recovery
Thursday	3/4-Effort, 4 x 1,000m at 3,000m Goal Pace

End of the Sharpening Period / Beginning of the Ascent

HIGH SCHOOL 3,000 METERS

Beginning of the Sharpening Period

First Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, 3(4 x 300m) at 1,500m Goal Pace
Wednesday	Time Trial or Active Recovery
Thursday	1/2-Effort, Fartlek + 4 x 200m at Finishing Speed
Friday	Active Recovery
Saturday	3/4-Effort, 6 x 800m at 3,000m Goal Pace
Sunday	Easy Effort, Long Run, 60-80 minutes

Worthwhile Break

Monday	Passive Recovery
Tuesday	Time Trial or Race 800m, 400m
Wednesday	Active Recovery + 4 x 150m at Finishing Speed
Thursday	Easy Recovery
Friday	Day Before Race Routine
Saturday	Race 3,000m
Sunday	Easy Effort, Long Run, 60-80 minutes

Second Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, 2(4 x 400m) at 1,500m Goal Pace
Wednesday	Active Recovery
Thursday	1/2-Effort, Fartlek + 4 x 150m at Finishing Speed
Friday	Active Recovery
Saturday	Time Trial or Race 2 x 800m
Sunday	Easy Effort, Long Run, 60-80 minutes
Monday	Passive Recovery
Tuesday	1/2-Effort, Fartlek + 4 x 150m at Finishing Speed
Wednesday	Active Recovery
Thursday	3/4-Effort, 4 x 1,000 at 3,000m Goal Pace

End of the Sharpening Period / Beginning of the Ascent

In this 3,000 meters schedule, the 2(4 x 400m) and 3 x 1,600m workouts in the second meso-cycle may have to be moved and delayed a day depending upon the recovery status of the athlete from the 3,000m race in the preceding week.

HIGH SCHOOL CROSS-COUNTRY 5,000 METERS

Beginning of the Sharpening Period

First Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, 3(4 x 300m) at 1,500m Goal Pace
Wednesday	Active Recovery
Thursday	1/2-Effort, Fartlek + 4 x 200m at Finishing Speed
Friday	Active Recovery
Saturday	3/4-Effort, 6 x 800m at 3,000m Goal Pace
Sunday	Easy Effort, Long Run, 60-90 minutes

Worthwhile Break

Monday	Passive Recovery
Tuesday	Time Trial 1,200m, full recovery, then 300m
Wednesday	Active Recovery + 4 x 200m at Finishing Speed
Thursday	Easy Recovery
Friday	Day Before Race Routine
Saturday	Race 5,000 meters
Sunday	Easy Effort, Long Run, 60-90 minutes

Second Meso-Cycle

Monday	Passive Recovery
Tuesday	1/2-Effort, Fartlek + 4 x 200m at Finishing Speed
Wednesday	Active Recovery
Thursday	3/4-Effort, 2(4 x 400m) at 1,500m Goal Pace
Friday	Active Recovery
Saturday	1/2-Effort, Fartlek + 4 x 200m at Finishing Speed
Sunday	Easy Effort, Long Run, 60-90 minutes
Monday	Passive Recovery
Tuesday	3/4-Effort, 4 x 1,200m at 5,000m Goal Pace

End of the Sharpening Period / Beginning of the Ascent

This 5,000 meters schedule provides 5 days between the 5,000m competition and the following 2(4 x 400m) sharpening workout to permit adequate recovery.

COLLEGIATE CROSS COUNTRY
WOMEN'S 5,000 METERS, AND MEN'S 10,000 METERS

Beginning of the Sharpening Period

First Meso-Cycle

Monday	Passive Recovery
Tuesday	3/4-Effort, 2-3 (5 x 300m) at 1,500m Goal Pace
Wednesday	Active Recovery
Thursday	1/2-Effort, Fartlek + 4 x 200m Finishing Speed
Friday	Active Recovery
Saturday	3/4-Effort, 6-8 x 800m at 5,000m Goal Pace
Sunday	Easy Effort, Long Run, 80-100 minutes

Worthwhile Break

Monday	Passive Recovery
Tuesday	Time Trial 1,200m, full recovery, then 300m
Wednesday	Active Recovery + 4 x 200m Finishing Speed
Thursday	Easy Recovery
Friday	Day Before Race Routine
Saturday	Race–men 8,000m, women 5,000m
Sunday	Active Recovery + 6-8 x 200m at 1,500m Goal Pace

Second Meso-Cycle

Monday	Easy Effort, Long Run, 80-100 minutes
Tuesday	Passive Recovery
Wednesday	3/4-Effort, 2(4 x 400m) at 1,500m Goal Pace
Thursday	Active Recovery
Friday	1/2-Effort, Fartlek + 4 x 200m at Finishing Speed
Saturday	Active Recovery
Sunday	3/4-Effort, 4-5 x 1,600m at 10,000m Goal Pace
Monday	Active Recovery
Tuesday	Easy Effort, Long Run, 70-90 minutes
Wednesday	Passive Recovery
Thursday	3/4-Effort, 4-5 x 1,000m at 5,000m Goal Pace

End of the Sharpening Period / Beginning of the Ascent

Comparison of Sharpening Work
Track & Field Events 400-10,000 Meters

KEY TO ABBREVIATIONS

AR	Active Recovery	**MRE**	Main Race Event
ER	Easy Recovery	**ODE**	Over-Distance Event
PR	Passive Recovery	**UDE**	Under-Distance Event
LR	Long Run	**XUDE**	X Under-Distance Event
TT	Time Trial	**@ 1/4**	1/4 Effort
F	Fartlek	**@ 1/2**	1/2 Effort
FS	Finishing Speed	**@ 3/4**	3/4 Effort
DBR	Day Before Race Session		

400m	**800m**	**1,500m**	**5,000m**
PR	PR	PR	PR
MRE 4-5 x 200m	MRE 3(4 x 300m)	MRE 3(4 x 300m)	UDE 3(4 x 300m)
AR	AR	AR	AR
4 x 60m Starts	F + FS 4 x 100m	F + FS 4 x 150m	F + FS 4 x 200m
AR	AR	AR	AR
ODE 3(3 x 300m)	ODE 2(4 x 400m)	ODE 6 x 800m	MRE 6-8 x 800m
LR	LR	LR	LR
PR	PR	PR	PR
Race 100m / 200m	Race 400m / 200m	Race 800m / 400m	TT 1,200m / 300m
AR	AR & FS 4 x 100m	AR & FS 4 x 150m	AR & FS 4 x 200m
ER & Starts	ER	ER	ER
DBR	DBR	DBR	DBR
Race 400m / 200m	Race 800m / 400m	Race 1,500m	Race 5,000m
LR	LR	LR	LR
PR	PR	PR	PR
ODE 3 x 500m	MRE 4 x 400m	MRE 2(4 x 400m)	F + FS 4 x 200m
AR	AR	AR	AR
3 x 60m Starts	F + FS 4 x 100m	F + FS 4 x 100m	UDE 2(4 x 400m)
AR	AR	AR	AR
MRE 3 x 300m	MRE 3 x 500m	TT 2 x 800m	F + FS 4 x 200m
LR	LR	LR	LR
PR	PR	PR	PR
3 x 60m Starts	F + 4 x 60 Starts	F + FS 4 x 100m	MRE 4 x 1,200m
AR	AR	AR	
ODE 2 x 600m	TT 600m / 300m	ODE 4 x 1,000m	

TABLE 4.12

100m	200m	300m	400m	500m	600m	800m	1,000m
10.5	21.0	31.5	42				
10.75	21.5	32.25	43				
11.0	22.0	33.0	44	54.0			
11.25	22.5	33.75	45	56.25			
11.5	23.0	34.5	46	57.5	69.5		
11.75	23.5	35.25	47	58.75	1:10.5		
12.0	24.0	36.0	48	60.0	1:12.0		
12.25	24.5	36.75	49	61.25	1:13.5	1:38	
12.5	25.0	37.5	50	62.5	1:15.0	1:40	
12.75	25.5	38.25	51	63.75	1:16.5	1:42	2:07.5
13.0	26.0	39.0	52	65.0	1:18.0	1:44	2:10.0
13.25	26.5	39.75	53	66.25	1:19.5	1:46	2:12.5
13.5	27.0	40.5	54	67.5	1:21.0	1:48	2:15.0
13.75	27.5	41.25	55	68.75	1:22.5	1:50	2:17.5
14.0	28.0	42.0	56	70.0	1:24.0	1:52	2:20.0
14.25	28.5	42.75	57	71.25	1:25.5	1:54	2:22.5
14.5	29.0	43.5	58	72.5	1:27.0	1:56	2:25.0
14.75	29.5	44.25	59	73.75	1:28.5	1:58	2:27.0
15.0	30.0	45.0	60	75.0	1:30.0	2:00	2:30.0
15.25	30.5	45.75	61	76.25	1:31.5	2:02	2:32.5
15.5	31.0	46.5	62	77.5	1:33.0	2:04	2:35.0
15.75	31.5	47.25	63	78.75	1:34.5	2:06	2:37.5
16.0	32.0	48.0	64	1:20.0	1:36.0	2:08	2:40.0
16.25	32.5	48.75	65	1:21.25	1:37.5	2:10	2:42.5
16.5	33.0	49.5	66	1:22.5	1:39.0	2:12	2:45.0
16.75	33.5	50.25	67	1:23.75	1:40.5	2:14	2:47.5
17.0	34.0	51.0	68	1:25.0	1:42.0	2:16	2:50.0
17.25	34.5	51.75	69	1:26.25	1:43.5	2:18	2:52.5
17.5	35.0	52.5	70	1:27.5	1:45.0	2:20	2:55.0
17.75	35.5	53.25	71	1:28.75	1:46.5	2:22	2:57.5
18.0	36.0	54.0	72	1:30.0	1:48.0	2:24	3:00.0
18.25	36.5	54.75	73	1:31.25	1:49.5	2:26	3:02.5
18.5	37.0	55.5	74	1:32.5	1:51.0	2:28	3:05.0
18.75	37.5	56.25	75	1:33.75	1:52.5	2:30	3:07.5
19.0	38.0	57.0	76	1:35.0	1:54.0	2:32	3:10.0
19.25	38.5	57.75	77	1:36.25	1:55.5	2:34	3:12.5
19.5	39.0	58.5	78	1:37.5	1:57.0	2:36	3:15.0
19.75	39.5	59.25	79	1:38.75	1:58.5	2:38	3:17.5
20.0	40.0	60.0	80	1:40.0	2:00.0	2:40	3:20.0
20.5	41.0	61.5	82	1:42.5	2:03.0	2:44	3:25.0
21.0	42.0	63.0	84	1:45.0	2:06.0	2:48	3:30.0
21.5	43.0	64.5	86	1:47.5	2:09.0	2:52	3:35.0
22.0	44.0	66.0	88	1:50.0	2:12.0	2:56	3:40.0
22.5	45.0	67.5	90	1:52.5	2:15.0	3:00	3:45.0
23.0	46.0	69.0	92	1:55.0	2:18.0	3:04	3:50.0
23.5	47.0	70.5	94	1:57.5	2:21.0	3:08	3:55.0

TABLE 4.13—Pace Schedules, 100-1,000 meters

100m	200m	300m	400m	500m	600m	800m	1,000m	1,500m	1,600m	3,000m	3,200m	5,000m	10,000m
10.5	21.0	31.5	42										
10.75	21.5	32.25	43										
11.0	22.0	33.0	44	54.0									
11.25	22.5	33.75	45	56.25									
11.5	23.0	34.5	46	57.5	69.5								
11.75	23.5	35.25	47	58.75	1:10.5								
12.0	24.0	36.0	48	60.0	1:12.0								
12.25	24.5	36.75	49	61.25	1:13.5	1:38							
12.5	25.0	37.5	50	62.5	1:15.0	1:40							
12.75	25.5	38.25	51	63.75	1:16.5	1:42	2:07.5						
13.0	26.0	39.0	52	65.0	1:18.0	1:44	2:10.0						
13.25	26.5	39.75	53	66.25	1:19.5	1:46	2:12.5						
13.5	27.0	40.5	54	67.5	1:21.0	1:48	2:15.0	3:22.5	3:36				
13.75	27.5	41.25	55	68.75	1:22.5	1:50	2:17.5	3:26.2	3:40				
14.0	28.0	42.0	56	70.0	1:24.0	1:52	2:20.0	3:30.0	3:44				
14.25	28.5	42.75	57	71.25	1:25.5	1:54	2:22.5	3:33.7	3:48				
14.5	29.0	43.5	58	72.5	1:27.0	1:56	2:25.0	3:37.5	3:52	7:15.0	7:44		
14.75	29.5	44.25	59	73.75	1:28.5	1:58	2:27.0	3:41.2	3:56	7:22.5	7:52		
15.0	30.0	45.0	60	75.0	1:30.0	2:00	2:30.0	3:45.0	4:00	7:30.0	8:00	12:30.0	
15.25	30.5	45.75	61	76.25	1:31.5	2:02	2:32.5	3:48.7	4:04	7:37.5	8:08	12:42.5	
15.5	31.0	46.5	62	77.5	1:33.0	2:04	2:35.0	3:52.2	4:08	7:45.0	8:16	12:55.0	25:50
15.75	31.5	47.25	63	78.75	1:34.5	2:06	2:37.5	3:56.2	4:12	7:52.5	8:24	13:07.5	26:15
16.0	32.0	48.0	64	1:20.0	1:36.0	2:08	2:40.0	4:00.0	4:16	8:00.0	8:32	13:20.0	26:40
16.25	32.5	48.75	65	1:21.25	1:37.5	2:10	2:42.5	4:03.7	4:20	8:07.5	8:40	13:32.5	27:05
16.5	33.0	49.5	66	1:22.5	1:39.0	2:12	2:45.0	4:07.5	4:24	8:15.0	8:48	13:45.0	27:30
16.75	33.5	50.25	67	1:23.75	1:40.5	2:14	2:47.5	4:11.2	4:28	8:22.5	8:56	13:57.5	27:55
17.0	34.0	51.0	68	1:25.0	1:42.0	2:16	2:50.0	4:15.0	4:32	8:30.0	9:04	14:10.0	28:20
17.25	34.5	51.75	69	1:26.25	1:43.5	2:18	2:52.5	4:18.7	4:36	8:37.5	9:12	14:22.5	28:45
17.5	35.0	52.5	70	1:27.5	1:45.0	2:20	2:55.0	4:22.5	4:40	8:45.0	9:20	14:35.0	29:10
17.75	35.5	53.25	71	1:28.75	1:46.5	2:22	2:57.5	4:26.2	4:44	8:52.5	9:28	14:47.5	29:35
18.0	36.0	54.0	72	1:30.0	1:48.0	2:24	3:00.0	4:30.0	4:48	9:00.0	9:36	15:00.0	30:00
18.25	36.5	54.75	73	1:31.25	1:49.5	2:26	3:02.5	4:33.7	4:52	9:07.5	9:44	15:12.5	30:25
18.5	37.0	55.5	74	1:32.5	1:51.0	2:28	3:05.0	4:37.5	4:56	9:15.0	9:52	15:25.0	30:50
18.75	37.5	56.25	75	1:33.75	1:52.5	2:30	3:07.5	4:41.2	5:00	9:22.5	10:00	15:37.5	31:15
19.0	38.0	57.0	76	1:35.0	1:54.0	2:32	3:10.0	4:45.0	5:04	9:30.0	10:08	15:50.0	31:40
19.25	38.5	57.75	77	1:36.25	1:55.5	2:34	3:12.5	4:48.7	5:08	9:37.5	10:16	16:01.5	32:05

TABLE 4.14—Pace Schedules, 100-10,000 meters

800m	1,600m	3,000m	5,000m	10,000m
1:50	4:04	8:02	13:51	28:45
1:48	4:00	7:54	13:37	28:17
1:46	3:56	7:46	13:24	27:51
1:44	3:52	7:38	13:11	27:25
1:42	3:48	7:30	12:58	26:59
1:40	3:44	7:22	12:46	26:34

TABLE 4.15

Career Progression of Quantity and Quality

Up to this point, relatively little has been said about the progression of sharpening work over years of training and development. A young athlete initially exhibits relatively rapid improvements in performance, and the quality of the sharpening work should be modified accordingly. However, an improvement in pace of approximately one second / 400 meters is normally all a mature distance runner can hope to safely assume within a calendar year. This sounds precious little, but given the passage of time, the practical result is dramatic. Remember, a ten-year developmental period is normally required for elite performance in the distance events. Table 4.15 illustrates the annual progression of performance associated with an improvement in pace of approximately one second / 400 meters in the 800-to-10,000-meter events.

The length of the recovery periods taken by different athletes in any given sharpening workout will vary considerably, depending upon their age and level of development, but the need to provide a recovery period that permits the pulse rate to return to 120 bpm remains nearly constant. The exceptions would be those workouts intended to develop the anaerobic ATP-lactic acid system (often used in training athletes for 800 meters), and the controlled recovery (CR) sessions (often used in training athletes for 5,000 and 10,000 meters). Otherwise, any reduction in the duration of the recovery periods should for the most part just happen with an athlete's improved aerobic ability and anaerobic power over time—it should not be aggressively pursued. Training frequency will also increase, because mature athletes will often undertake two-a-day workouts, and sometimes conduct quality training and racing efforts in closer proximity. This reflects their superior load and recovery capacity. The quantity assumed in the sharpening period will also progress over time:

- The volume assumed in the individual workouts will increase.
- The balance of the training for any given event often shifts towards the over-distance side, since higher levels of competition are associated with more numerous preliminary heats, which place greater demands on an athlete's stamina.
- Having fully developed their potential at the shorter race events, athletes will move up to the next over-distance event.

However, from the standpoint of optimal development, it is a mistake for athletes to rapidly advance to the longer distances without fully developing their potential in the middle distance events. This practice would shorten the length of their competitive careers and limit their ultimate level of performance.

Race Practice and Callusing

The race will be what the training has been. In practice, this means that the physical and mental conditioning being instilled by the training loads must be addressed from three perspectives.

The first is called the micro-view: regard each rep as a compressed form of the main race event. Earlier, reference was made to the example of an athlete with the habit of slowing down during the last five to 10 meters of a race. This weakness was acquired by the repetition of a thousand such lapses during the course of previous training. From the micro-view perspective, it is easy to see how such habits can be instilled—both good and bad. Therefore, athletes are well advised to make a habit of running the second half of their workouts faster than the first. Moreover, they should always finish off the individual reps within an interval or repetition workout forcefully and completely.

The second perspective is called the exploded view: Regard the entire training session, including the reps and recoveries, as an exploded view of the main race event. By stressing various parts of the larger workout, it is possible to acquire competitive abilities, and eliminate areas of weakness. When the micro and exploded views are combined, the physical and mental conditioning can be shaped dramatically.

The third perspective is called the macro-view: It refers to the dynamic movement of the larger training progression.

All three perspectives can be used to effect substantial physical and mental conditioning. Sometimes an athlete exhibits an area of weakness in the main race event that needs to be addressed. On the other hand, sometimes certain competitive strengths need to be cultivated. The portrait of the main race event revealed by taking splits then needs to be put to good use. By applying the insights provided by the micro, exploded, and macro-views, the individual sessions and larger training progression can be designed to eliminate evident weaknesses and instill formidable competitive abilities. For example, let's suppose an athlete has recently exhibited weakness in the fifth and sixth laps of the 3,000 meters event, and the next workout in the training progression is 5 x 1,000 meters at 3,000-meter goal pace with a 400 meters jog recovery. How could this training session be redesigned to remedy the athlete's area of weakness?

First, conceive of each 1,000 meters repetition as a condensed version of the main race event (micro-view). In this case, stress the third quarter of each 1,000 meters repetition to bring the athlete up to par both physically and mentally. But also view the entire 5 x 1,000 meters workout as an exploded view of the main race event. Therefore, you should also stress the third quarter of the training session when taken as a whole. Thus, in some sense, you can work at the problem from two angles.

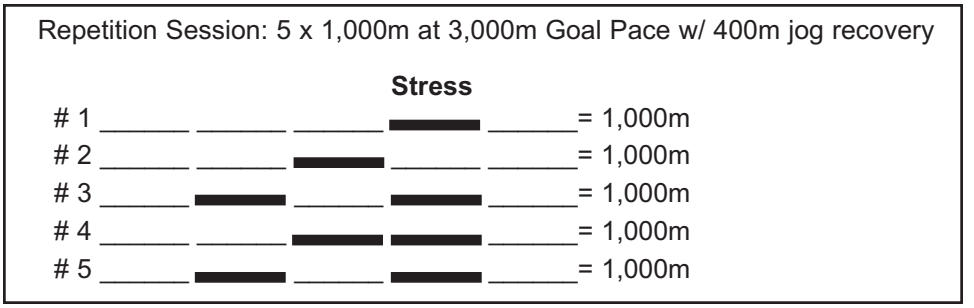


FIGURE 4.10

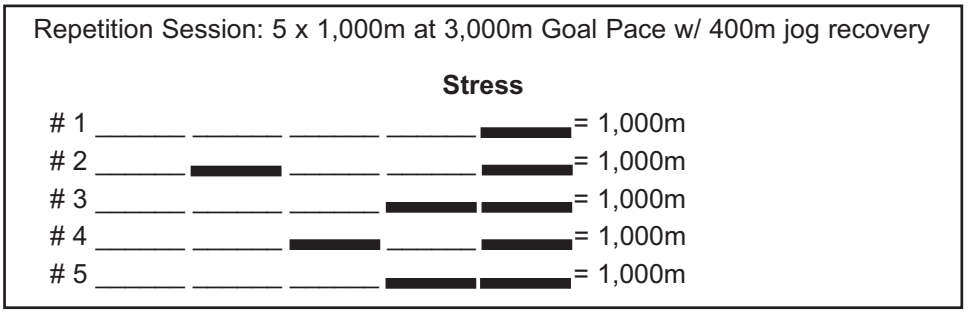


FIGURE 4.11

Figure 4.10 indicates 200-meter segments within the individual repetitions of the larger 5 x 1,000 meters training session. Darker lines represent heavily stressed segments where the athlete would run faster than goal pace. Obviously, the faster the stressed segments are run, the more difficult it will be to maintain goal pace over the entire workout. Ideally, it would be desirable to have the total time of the unevenly paced 1,000 meters repetitions come out at goal pace, but since this represents a significant improvement in the quality of the training, only mature athletes should make the attempt. If an athlete exhibited weakness in the last 800 meters of the 3,000 meters event, it would be prudent to conduct stressed segments in the manner shown in Figure 4.11.

Many individuals hold the misconception that weakness exhibited in the final stages of a competition means that a runner's finishing speed is inadequate. If this truly is the case, the problem can be easily diagnosed by timing the athlete over a few reps at 100 to 200 meters distance. However, more often the runner lacks sufficient stamina and over-distance ability. When this is the problem, conducting under-distance work is just the opposite of what the athlete needs. But what if, by all indications, the individual's stamina and raw speed are adequate for the task? In this case, the athlete is insufficiently conditioned or callused to finish well (For a discussion of the callusing effect see Dellinger and Beres, 1978). Accordingly, attempting to improve an athlete's kick by sprinting 100 to 200 meters is not going to solve the problem either—that is, unless those sprints are placed at the end of longer repetitions, thereby simulating race conditions.

These conditioning methods can be used to prepare athletes for particular courses, or other environmental factors which are anticipated in championship competitions. For example, a common practice would be to condition athletes for especially demanding hills and terrain on a given cross-country course. Again, athletes will race as they have trained.

As previously discussed, athletes must be conditioned by pace work to develop a dominant neuromuscular stereotype, or mental clock, that will sustain them through the later stages of a competition. However, unless an individual is superior enough to sustain an even pace that none can follow, some other competitive abilities are required. To enjoy success athletes must acquire the ability to:

- Surge
- Make the breakaway
- Execute an effective finishing kick

All of these abilities are developed by race-practice, and in fact, this is the only kind of practice that athletes should ever conduct! Figure 4.12 shows another single training session structured to induce determinate physical and mental effects. By employing the macro perspective, you can similarly structure the entire training progression for the athletic season. In the course of the date pace work or the early interval sessions, it is undesirable to do anything counterproductive to the task of instilling a dominant pace sense. Further, intervals often have too short a duration to lend themselves to the segmentation that is possible with the later repetition workouts. So, with the early interval training, it is most effective to stress the recovery periods and stack the density of the workout in the desired areas, rather than to disturb the even pacing of the series. For example, Figure 4.12 illustrates the possible modification of an interval workout for a mature athlete who exhibits weakness in the third quarter of the 5,000 meters (Note: the presence of a circle indicates shortening of the associated recovery period).

Accordingly, you can structure the entire training progression to instill various competitive abilities, or eliminate evident areas of weakness. In all race practice, the relative effort and mode of conditioning is of primary importance. In this respect, the times posted are secondary to the manner in which the training sessions are conducted. However, mature athletes can eventually progress to conduct the training sessions in a manner that will not compromise either aspect. It can be advantageous for middle distance runners to compete in the main race event during the worthwhile break that is placed in the middle of the sharpening period. This can provide an indication with respect to any areas needing special attention prior to the repetition workouts, which are especially suitable for the task of callusing. Figure 4.13 provides an example of a training progression for an athlete whose athletic level corresponds to 13:20 for 5,000 meters.

4 (5 x 200m) 100m jog recovery; 200m jog recovery at the set

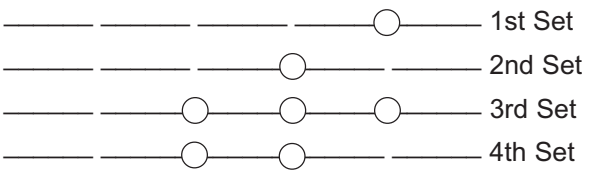


FIGURE 4.12

Session 1: 4 (5 x 400m), 100m jog recovery; 400m jog recovery at series break

1st Set	66	64	66	64	66
2nd Set	64	66	64	66	64
3rd Set	66	63	66	63	66
4th Set	66	64	66	63	60

Session 2: 2(4 x 800m), 200m jog recovery; 400m jog recovery at series break

1st	2:10	65	65
2nd	2:08	33/31	33/31
3rd	2:10	65	65
4th	2:08	33/31	31/33
5th	2:08	33/31	33/31
6th	2:08	33/31	31/33
7th	2:08	31/33	31/33
8th	2:02	31/31	30/30

Session 3: 5 x 1,200m, 400m Controlled Recovery in 90-120 Seconds

1st	63	65	65	3:13
2nd	65	31/33	31/33	3:13
3rd	65	62	65	3:12
4th	65	30/33	30/33	3:10
5th	65	64	31/29	3:09

Session 4: 4 x 1,600m, 400m jog recovery

1st	66	66	66	64	4:22
2nd	65	31/33	31/33	63	4:18
3rd	65	65	61	65	4:16
4th	65	65	64	60	4:14

FIGURE 4.13

Mega-Cycle Progression and Race Practice

Certain measures relating to achieving peak performance in the last year of a multiple year developmental cycle have been addressed in Chapter 1. Obviously, the initial requirement with respect to sharpening work is to assume the necessary quantity in the training sessions. Accordingly, the workouts should first be conducted at goal pace in an evenly paced manner before attempting any callusing work. Race practice and callusing work should then be emphasized in latter portion of a multiple year developmental and peaking scenario, such as the junior and senior year of a high school or collegiate career. Athletes desiring to peak in the fourth year of a developmental cycle for the Olympic Games should introduce the required callusing work in the third year, and then polish their skills during the Olympic year.

In closing this treatment of the sharpening period and race practice, athletes would do well to consider the advice of an individual who placed fifth in the modern Pentathlon at the 1912 Olympic Games—who fell unconscious at the finish of the cross-country event.

> ***Do not regard what you do as only preparation for doing the same thing more fully or better at some later time. Nothing is ever done twice. There is but one time to do a thing that is the first and last... there is no next time... Everything is a final heat. There are no practices...***
>
> —George S. Patton